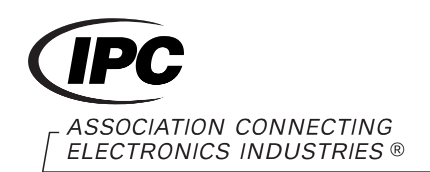

IPC-2546
with Amendment 1

Sectional Requirements for Shop-Floor Equipment Communication Messages (CAMX) for Printed Circuit Board Assembly

Endorsed by the National Electronics Manufacturing Initiative (NEMI)

IPC-2546
with Amendment 1
January 2003

A standard developed by IPC

Supersedes IPC-2546
October 2001

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IPC-2546

– ASSEMBLY

Sectional Requirements for Shop-Floor Equipment Communication Messages (CAMX) for Printed Circuit Board Assembly

A standard developed by the Assembly XML Schema Formatting Task Group (2-13b) of the Shop Floor Communications Subcommittee (2-13) of IPC.

The IPC-2546 standard defines an XML encoding schema, specific to printed ciruit board assembly equipment, which enables a detailed definition of electronics assembly equipment messages to be encoded at a level appropriate to facilitate plug-and-play characteristics in a factory's shop-floor information system.

This project was initiated by the NEMI Plug-and-Play Factory Project which established proof of concept. After completion, the project leaders recommended standardization by IPC under the ANSI rules and procedures.

March 10, 2003

Supersedes:
IPC-2546 - October 2001

Users of this standard are encouraged to participate in the development of future revisions.

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Acknowledgment

Any Standard involving a complex technology draws material from a vast number of sources. While the principal members of the Assembly XML Schema Formatting Task Group (2-13b) of the Shop Floor Communications Subcommittee (2-13) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of the IPC extend their gratitude.

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A special note of thanks goes to the following individuals for their dedication to bringing this project to fruition. We would also like to highlight those individuals who were involved with the initial NEMI program concept and made major contributions to the development of the standard.

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Sectional Requirements for Shop-Floor Equipment Communication Messages (CAMX) for Printed Circuit Board Assembly

Introduction

Factory Information Systems (FIS) form the nervous system of an enterprise, analysing data and delivering information to the machines and people who need to make information-based decisions. These systems provide a bi-directional flow of information between the factory floor and the rest of the enterprise. The National Electronics Manufacturing Initiative's (NEMI) Plug & Play Factory project addressed some critical problems involving factory information information system deployment on the electronics manufacturing factory floor. The Plug & Play Factory project focused on the development of standards necessary to achieve interoperability – or, plug-and-play capability – on the factory floor . Activities were comprised of three areas:

- Definition of standards for a software framework that will allow interoperability among software and equipment produced by different vendors.
- Development of process-specific, machine communication interface standards for surface mount equipment. These standards will leverage the Generic Equipment Model (GEM) specification developed for semiconductor equipment and web-based standards for data transmission.
- Establishment of a test-bed manufacturing line to prove the concepts developed by the project.

1 SCOPE

IPC-2546 describes the event message content specific to assembly equipment. This standard **shall** be used together with the IPC-2541 standard entitled "Generic Requirements for Electronics Manufacturing Shop Floor Equipment Communication (CAMX)", which defines the set of messages and key attributes of the generic equipment class used in electronics manufacturing.

The types of processes covered by IPC-2546 include material movement systems like conveyors and buffers, manual placement, automated screen printing, automated adhesive dispensing, automated surface mount placement, automated plated through hole placement, forced convection and infrared reflow ovens, and wave soldering.

1.1 Interpretation

"Shall", the emphatic form of the verb, is used throughout this standard whenever a requirement is intended to express a provision that is mandatory. Deviation from a **shall** requirement is not permitted, and compliance with the XML syntax and semantics **shall** be followed without ambiguity, or the insertion of superfluous information.

The words "should" and "may" are used whenever it is necessary to express non-mandatory provisions.

"Will" is used to express a declaration of purpose.

To assist the reader, the word **shall** is presented in bold characters.

2 Applicable documents

The following documents contain provisions, which, through reference in this text, constitute provisions of this standard. All documents are subject to revision. Parties who make agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents indicated below.

IPC-T-50	Terms and Definitions for Interconnecting and Packaging Electronic Circuits
IPC 2500	Generic Computer Aided Manufacturing (CAMX) Framework definitions
IPC 2511	Generic Computer Aided Manufacturing (GenCAM) descriptions for Printed Circuit Boards and Printed Board Assemblies
IPC 2541	Generic Requirements for Electronics Manufacturing Shop Floor Equipment Communication (CAMX)
IPC 2547	Sectional Requirements for Specific Printed Circuit Board Inspection and Test Equipment

3 General Requirements

The requirements of IPC-2541 are a mandatory part of this standard. That document describes the generic requirements for the CAMX format.

3.1 Date and Time Notation

All 2540 standards **shall** use the World Wide Web consortium (W3C) date time standard. This standard **shall** use the Complete Date plus Hours, Minutes, Seconds, and a decimal fraction of a second and Time Zone Designator. Two decimal places will be used in order to represent time down to a hundredth of a second. For additional information on date and time, see web page:

http://www.w3.org/TR/1998/NOTE-datetime-19980827

3.2 CAMX Compliance

The IPC-2501 document defines a message packet structure. The IPC-2541 document defines a set of Equipment, Recipe, Item, and Operator events and related message formats. All screen printers, adhesive dispensers, surface mount placement machines, through hole placement machines, forced convection and infrared reflow ovens, final assembly and packaging equipment that comply with the IPC-2546 standards **shall** also comply with the event messages contained in the IPC-2541 standard as well as those events that are described in this document. All event messages **shall** be formatted in compliance with the IPC-2501 message packet structure.

4 Generic Assembly Equipment Events and Message Formats

4.1 Dictionary of Common Terms

AirSupply
The source of the air supplied to operate the machine elements. One of possibly many sources of energy used to run the machine.

Controller
The device that directs the operation of a part of the machine. Some examples are motion or vision or sequence controllers.

Environmental Control Unit (ECU)
A subsystem that monitors and controls the overall temperature and humidity of the machine.

Inspection
The technique used to analyse the quality of the process.

ItemRecognition/Vision System
A subsystem that captures images of the items being processed. The ItemRecognition/Vision System is typically used for alignment, locating features, and inspection.

MaterialSupplyArea
The area in the machine were material is supplied to the machine. This could be a feeder area, tray area, glue area, adhesive area etc.

Network
Any software or hardware related to a network connect.

OperatingSystem
This is the software environment used by the controllers.

PowerSupply
The source of the voltage and current to operate the machine elements. One of possibly many sources of energy used to run the machine.

Process
The sequence of events required to locate and align the product and perform a specific machine operation.

Safety
The protection mechanism to keep a human from harm or injury.

Scanner
This is used to scan: items, components, feeders, material. Some examples of are specific id tags are: i.e. barcode, 2D barcode, linear barcode, touch memory cell, RF tag.

Software
Any software that is used on the machine.

Tooling
The mechanism used to support the product during the machine operation.

Transport
The mechanism required to implement the following:

- To load the product into the machine before a process begins.
- To secure the product in the machine during the machines operation.
- To unload the product after the machine operation is complete.
- Protocol (messages or signals) between this machine and the upstream and downstream machines.

VacuumGenerator
A system used to generate the vacuum in the machine.

Verification
This is a system that validates a process. It can be a camera, electrical probe etc.

4.2 Model of Equipment

Under Consideration*

4.3 Dictionary of Attributes

Attribute Name	Attribute Type	Description
command	string	A Specific action associated with a recipe step
designator	string	Identifies a unique location on the board.
description	string	Human readable description of the error
errorType	string	Describes the type of error message.
fromParameterValue	string	Value of parameter before change
imageId	string	The IPC-2510 Image. This is typically a single circuit in the panel array
imageShape	string	Shape of the image. Some types are Disc, Rectangle, Swiss Cross, Donut, Diamond, etc.
imageType	enumerated string	LOCAL | GLOBAL
increment	double	Resolution of a parameter
informationType	string	Describes the type of information message.
laneList	string list	Identifies the lane(s) executing a recipe
maximum	double	Maximum value of a parameter
messageInitiator	enumerated string	A description of how this message was initiated. OPERATOR | HOST | AUTOMATIC.
minimum	double	Minimum value of a parameter
nameId	string	The name of a parameter
nominal	double	Expected value of a parameter

Attribute Name	Attribute Type	Description
parameterId	string	Identifies a parameter. Something like LaneOneBoardSpeedSetting or ZoneOneTemperatureSetting
recipeId	string	Identifies the Recipe
revision	string	Identifies the revision
recipeStep	string	Recipe step associated with the element
recognitionReference	string	Reference name used by the recognition system and/or the recipe.
scannedLot	string	Scanned Identification of the unit of component delivery, like a tape or bulk
scannerId	string	Identifies Scanner
score	positiveInteger	Identifies confidence level
subsystemId	string	Identification of a Subsystem like "Network Interface Card"
subsystemType	string	Type of subsystem, this might be ItemRecognition | ComponentRecognition | Transport | Nozzlechanger | Head | Headgroup | Cutting | ComponentsApplyArea | Controller | Network | Software | Scanner | Applicator | Cleaner | Inspection | MotionControl | OperatingSystem | PowerSupply | AirSupply | PrintMedium | PrintStencil | Tooling | Transport | Verification | Communications | Safety | ECU
toParameterValue	string	Value of parameter after change
units	string	Units of a parameter
value	double	Value of a parameter
vendorErrorCode	string	Vendor specific Error Code
warningType	string	This describes the type of warning.
zoneList	string list	Identifies the zone(s) executing a recipe

4.4 Dictionary of Nested Elements

The following tables define the attributes of nested elements that are appropriate for assembly functions. These elements are necessary for tracking product and process quality. The right-most column indicates the expected number of occurrences (cardinality) of each attribute or element. 0-1 indicates an optional field. 1-1 indicates a single mandatory field. 0-n indicates any number, including zero. 1-n indicates at least one.

4.4.1 Element: BadBoardMark

Description: Information about a specific bad board mark.

Attribute Name	Attribute Type	Description	Occurrence
imageId	string	The IPC-2510 Image. Typically a single circuit in the panel array	1-1
designator	string	Identifies a unique location on the board.	0-1
imageType	enumerated string	LOCAL | GLOBAL	0-1

```
<BadBoardMark
      imageId="2"
      designator="B1"
      imageType="LOCAL"
/>
```

4.4.2 Element: Fiducial

Description: Information about a specific fiducial.

Attribute Name	Attribute Type	Description	Occurrence
designator	string	Identifies a unique location on the board.	1-1
imageId	string	The IPC-2510 Image. Typically a single circuit in the panel array	0-1
imageType	Enumerated string	LOCAL | GLOBAL	0-1
imageShape	string	Shape of the image. Some types are Disc, Rectangle, Swiss Cross, Donut, Diamond, etc.	0-1
recognitionReference	String	Reference name used by the recognition system and/or the recipe.	0-1
score	positiveInteger	Identifies confidence level	0-1

```
<Fiducial
      designator="F1"
      imageId="2"
      imageType="GLOBAL"
      imageShape="Rectangle"
      recognitionReference="123.gf"
      score=90
/>
```

4.4.3 Element: MachineError

Description: Information about an error in the machine. This element shall have the element *Subsystem* imbedded as a part of the Machine Error message

Attribute Name	Attribute Type	Description	Occurrence
Subsystem	See 4.4.6	Information about a specific subsystem	1-1
vendorErrorCode	string	Vendor specific Error Code	0-1
description	string	Human readable description of the error	0-1

```
<MachineError
     vendorErrorCode="NW1002139123"
     description="Network not reachable">
     <Subsystem
          subsystemType="Network"
          subsystemId="Ethernet Adapter:1"
     />
</MachineError>
```

4.4.4 Element: Parameter

Description: A record of the name, value and units for an equipment parameter. Optional constraints can also be applied to the parameter.

Attribute Name	Attribute Type	Description	Occurrence
nameId	string	The name of a Parameter	1-1
value	double	Value of a parameter	1-1
units	string	Units of parameter	1-1
nominal	double	Expected value of a parameter	0-1
minimum	double	Minimum value of a parameter	0-1
maximum	double	Maximum value of a parameter	0-1
increment	double	Resolution of a parameter	0-1

```
<Parameter
          nameId = "PrintSpeed"
          value = "100.0"
          units = "mm/s"
          nominal = "100.0"
          minimum = "0.0"
          maximum = "200.0"
          increment = "1.0"
/>
```

4.4.5 Element: Recipe

Description: The Recipe element uniquely identifies the recipe, program or algorithm set that is being applied at the station.

Attribute Name	Attribute Type	Description	Occurrence
recipeId	string	Identifies the name of the recipe	1-1
revision	string	Identifies the revision of the recipe	0-1
zoneList	string list	Identifies the zone(s) executing this recipe	0-1
laneList	string list	Identifies the lane(s) executing this recipe	0-1
recipeStep	string	Identifies the step of the executing recipe	0-1
command	string	Command in the recipe such as line number or process step.	0-1

```
<Recipe
      recipeId="VCR-2912"
      revision="4"
      zoneRange="1,2"
      laneRange="1,2"
/>
```

4.4.6 Element: Subsystem

Description: Information about a specific Subsystem.

Attribute Name	Attribute Type	Description	Occurrence
subsystemType	string	Unique area found on the machine	1-1
subsystemId	string	Unique location on the machine	1-1
revision	string	Identifies the revision of the subsystem	0-1

```
<Subsystem
      subsystemType="Scanner"
      subsystemId="Zone 1: Lane 1:top"
/>
```

4.5 Extensions to IPC-2541 Mandatory Messages

The following tables define the event message attributes or elements that are appropriate for assembly functions. These events are necessary for tracking product and process quality. The right-most column indicates the expected number of occurrences (cardinality) of each attribute or element. 0-1 indicates an optional field. 1-1 indicates a single mandatory field. 0-n indicates any number, including zero. 1-n indicates at least one.

4.5.1 IPC-2541 <EquipmentInformation> Message

4.5.1.1 informationId: BadBoardMarkReport

Definition: This is an indication that one or more Bad Board Marks were found on the item. For every found Bad Board Mark the equipment must send one Fiducial element.

Attribute/Element Name	Attribute / Element Type	Description	Occurrence
nameId	string	Name of bad board mark report	1-1
BadBoardMarkReport	See 4.4.1	Information about a specific bad board mark	1-n
Subsystem	See 4.4.6	Information about a specific Subsystem	0-1
Recipe	See 4.4.5	Identifies the recipe, program or algorithm	0-1

```
<BadBoardMarkReport
      nameId = "BadBoardMarkReport1">
            <BadBoardMark
                  imageId="2"
                  designator="B1"
                  imageType="LOCAL"
            />
            <Subsystem
                  subsystemType="Scanner"
                  subsystemId="Zone 1: Lane 1:top"
            />
            <Recipe
                  recipeId="VCR-2912"
                  revision="4"
                  zoneRange="1,2"
                  laneRange="1,2"
            />
</BadBoardDataReport>
```

4.5.1.2 informationId: StartSession

Under Consideration

4.5.1.3 informationId: EndSession

Under Consideration

4.5.1.4 informationId: SessionManagement

Under Consideration

4.5.1.5 informationId: ManagementData

Under Consideration

4.5.1.6 informationId: ProcessDataReport

Description: A report containing process data in order to permit SPC (Statistical Process Control) analysis

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
nameId	string	Name ofprocess data report	1-1
parameter	See 4.4.4	process data report parameter(s)	1-n

```
<ProcessDataReport
      nameId = "ProcessDataReport1">
     <Parameter
                nameId = "XError"
                value = "0.05"
                units = "mm"
                minimum = "-0.0"
                maximum = "0.1"
                increment = "0.01"
     />
     <Parameter
                nameId = "YError"
                value = "0.02"
                units = "mm"
                minimum = "-0.0"
                maximum = "0.1"
                increment = "0.01"
     />
</ProcessDataReport>
```

4.5.2 IPC-2541 <EquipmentParameterModified> Message

Definition: This is an extension to the IPC-2541 message

Attribute Name	Attribute Type	Description	Occurrence
ParameterId	string	Identifies a parameter. Something like LaneOneBoardSpeedSetting or ZoneOneTemperatureSetting	1-1
FromParameterValue	string	Value of parameter before change	0-1
ToParameterValue	string	Value of parameter after change	0-1

4.5.3 IPC-2541 <WaitingforOperatorAction> Message

Under Consideration

4.6 New Events

4.6.1 Event: EquipmentPoweringUp

Description: This event is sent when the machine is in the process of powering up. This is not mandatory but is helpful when the machine has knowledge that is in the process of powering up. It should occur before the Equipment is initialized.

Attribute Name	Attribute Type	Description	Occurrence
dateTime	dateTime	Date and time of the event	1-1
revision	string	Software or Firmware revision code	0-1

```
<EquipmentPoweringUP
      dateTime="2000-02-02T11:13:12.00-05:00"
      revision="Rev 3.2.0"
/>
```

5 Specific Assembly Equipment Events and Message Formats.

5.1 Specific Screen Printing Equipment Events and Message Formats (Print)

5.1.1 Dictionary of Screen Printing Terms

The objective of this model is to define a common naming convention for the subsystem categories used in screen printing machines.

5.1.1.1 Screen Printer Subsystems

PrintApplicator

The mechanism used to fix the medium to the product, e.g. a squeegee in stencil printer application.

StencilCleaner

The device used to clean the print medium off the stencil, e.g. Paper Roll.

PrintDispenser

A subsystem that supplies the medium to the stencil.

PrintMedium

The material applied to the product as a result of the printing process, e.g. Solder Paste.

PrintStencil

The mask used when applying the print medium to the product.

Table

This provides a support base for the tooling mechanism.

5.1.1.2 Limits Monitoring

Monitoring Limit

A monitoring limit divides the possible range of a parameter’s value into two parts, the upper zone and the lower zone. At any time the monitored parameter is considered to be in one and only one of these zones. If the value of a parameter crosses the zone boundary in either direction a MonitoringLimitZoneTransition event is generated (see Figure 1).

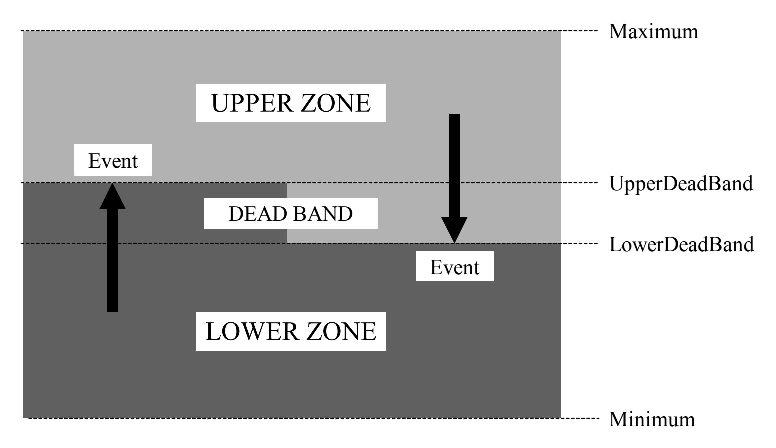


Figure 1 Zone Boundary Transition – Monitoring Limits

There is an area of overlap between the two zones called the dead band. The dead band is a key concept of limits monitoring, especially for floating point variables. Its purpose is to prevent a phenomenon known as chattering (the repeated changing of zones due to small, rapid fluctuations in a parameter's value while near the zone boundary).

In practice the value of a parameter must reach the opposite boundary of the dead band before a zone transition can occur. Thus, if a parameter's value reaches the UpperDeadBand and moves into the upper zone it will not return to the lower zone until the value falls back to the LowerDeadBand.

The difference between UpperDeadBand and LowerDeadBand should normally be greater than the typical amplitude of those fluctuations deemed insignificant. In some cases the width of the dead band may be set to zero. The range of values of UpperDeadBand and LowerDeadBand are limited by the following:

Maximum > UpperDeadBand >= LowerDeadBand > Minimum

Figure 2 illustrates the operation of the dead band when the following limit is used:

UpperDeadBand = 102, LowerDeadBand = 98, width of dead band = 4

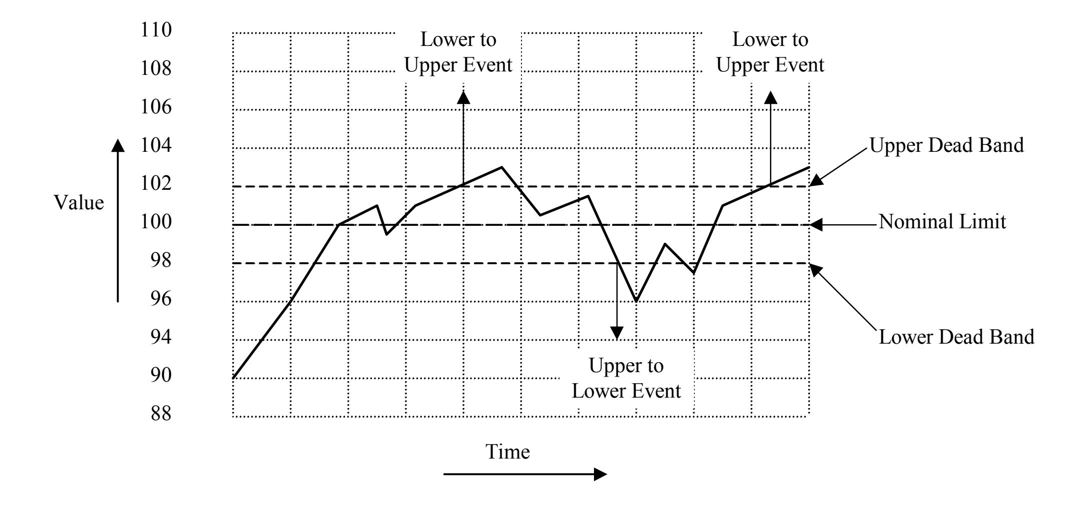


Figure 2 Example Graphing DeadBand Operation

5.1.2 Abstract Model of Screen Printer Item(s), Lane(s) and Zone(s)

Figure 3 shows an example comparing a two lane operation each having three separate Zones that must be monitored.

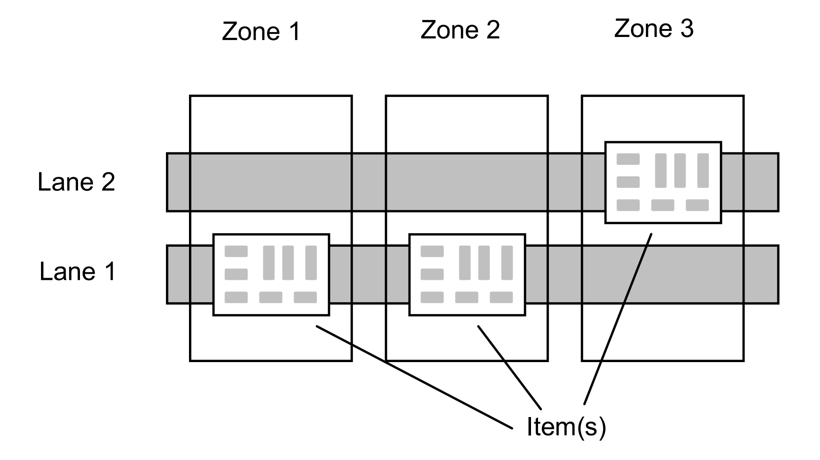


Figure 3 Multiple Lane, Multiple Zone Example

5.1.3 Abstract Model of Screen Printer Subsystems (Single Lane, Single Zone)

Figures 4 and Figure 5 show the conditions of the screen printer system for a single lane, having a single zone. Figure 4 is an exploded view; Figure 5 shows the details of the print operation.

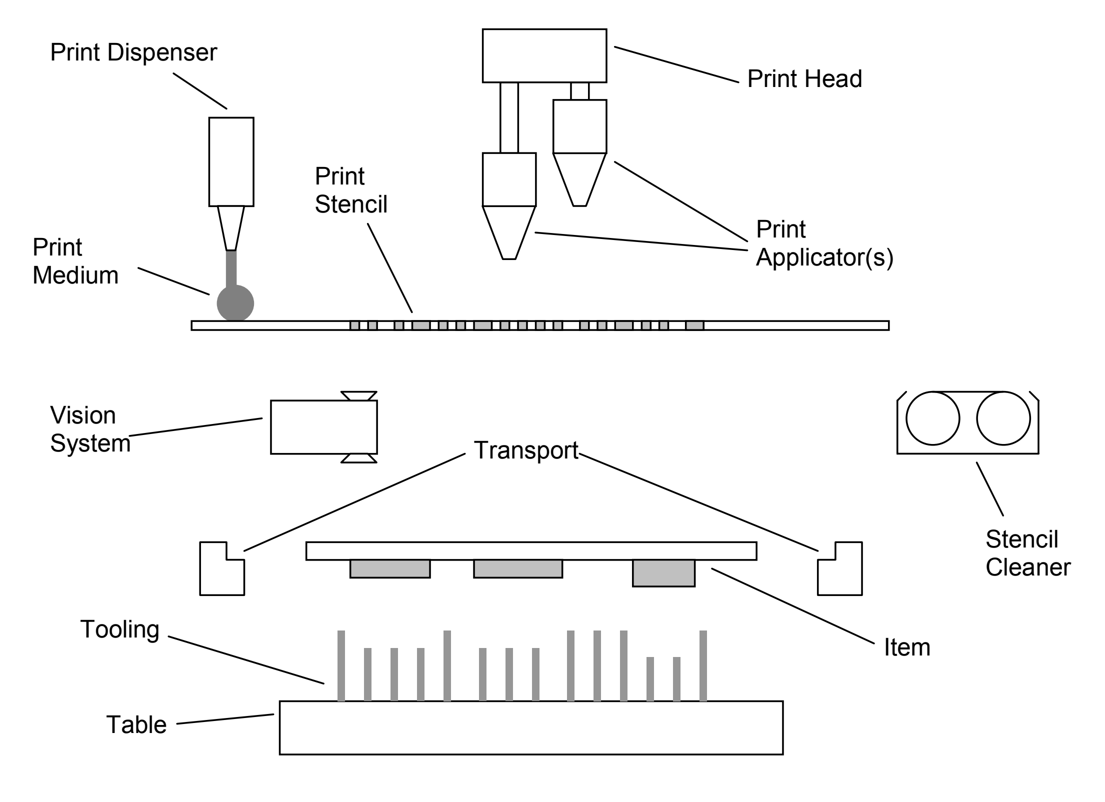


Figure 4 Exploded View

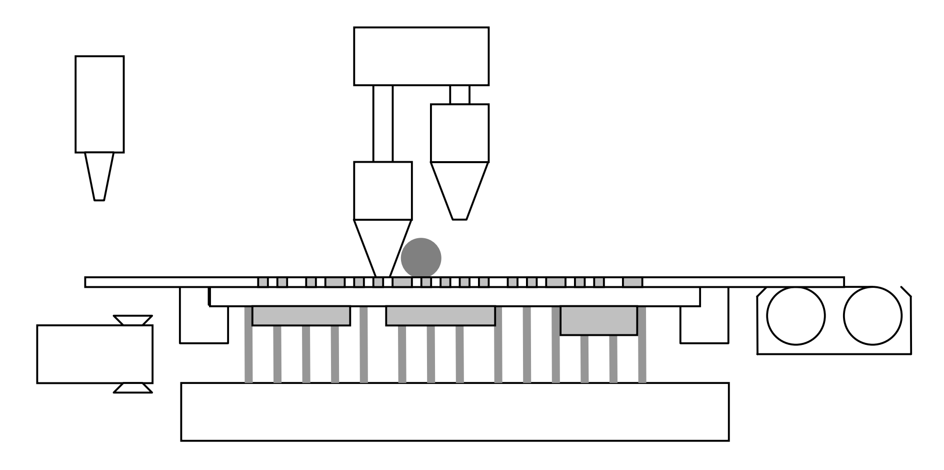


Figure 5 Print Operation View

5.1.4 Dictionary of Screen Printing Specific Attributes and Parameters

5.1.4.1 Screen Printing Recipe Parameters

The following table specifies the screen printing recipe parameters that may be adjusted during screen printer operation. Parameter adjustments will be reported via the EquipmentParameterModified event's Extensions element.

All parameters in the following table are defined using the Parameter element type.

nameId	Value Type	Description
BatchLimit	double	The number of items to print in one batch
CleaningFrequency	integer	The number of items to be printed between each cleaning cycle
InspectionFrequency	integer	The number of items to be printed between each inspection cycle
PrintMediumConditioningFrequency	integer	The number of items to be printed between each print medium conditioning cycle
PrintMediumDispenseFrequency	integer	The number of items to be printed between each print medium dispense cycle
PrintMediumDispenseSpeed	double	The linear speed of the print dispenser
FrontApplicatorPressureRecipe	double	The required force to be applied by the front applicator
FrontApplicatorSpeedRecipe	double	The required linear speed of the front applicator
FrontApplicatorAccelerationRecipe	double	The required acceleration of the front applicator
RearApplicatorPressureRecipe	double	The required force to be applied by the rear applicator
RearApplicatorSpeedRecipe	double	The required linear speed of the rear applicator

RearApplicatorAccelerationRecipe	double	The required acceleration of the rear applicator
FrontApplicatorSeparationDistanceRecipe	double	The required separation distance between the front applicator and stencil
FrontApplicatorSeparationSpeedRecipe	double	The required separation speed of the front applicator from the stencil
FrontApplicatorSeparationAccelerationRecipe	double	The required separation acceleration of the front applicator from the stencil
RearApplicatorSeparationDistanceRecipe	double	The required separation distance between the rear applicator and stencil
RearApplicatorSeparationSpeedRecipe	double	The required separation speed of the rear applicator from the stencil
RearApplicatorSeparationAccelerationRecipe	double	The required separation acceleration of the rear applicator from the stencil
ItemSeparationDistanceRecipe	double	The required separation distance between the item and stencil
ItemSeparationSpeedRecipe	double	The required separation speed of the item from the stencil
ItemSeparationAccelerationRecipe	double	The required separation acceleration of the item from the stencil
SeparationMode	String (enumeration)	The order in which the Applicator and Item separate after the print cycle is complete ITEMTHENAPPLICATOR | APPLICATORTHENITEM | SIMULTANEOUS
XOffset	double	The fixed offset in the X direction required to align the item with the print stencil
YOffset	double	The fixed offset in the Y direction required to align the item with the print stencil
ThetaOffset	double	The fixed offset rotation required to align the item with the print stencil

5.1.4.2 Screen Printing Process Data Parameters

The following table specifies Screen Printing Process Data parameters. All parameters are defined using the Parameter element type.

Parameter	Value Type	Description
XAlignment	double	The linear movement required in the X direction to align the item with the print stencil
YAlignment	double	The linear movement required in the Y direction to align the item with the print stencil
ThetaAlignment	double	The rotational movement required in the Theta direction to align the item with the print stencil
BoardStretch	double	The difference in fiducial separation on the item versus the difference in fiducial separation on the print stencil
MaxPrintMediumPresent	double	The maximum print medium present reported by the inspection system
MinPrintMediumPresent	double	The minimum print medium present reported by the inspection system
AvgPrintMediumPresent	double	The average print medium present reported by the inspection system
FrontApplicatorPressureActual	double	The actual force applied by the front applicator
FrontApplicatorSpeedActual	double	The actual linear speed of the front applicator
FrontApplicatorAccelerationActual	double	The actual acceleration of the front applicator
RearApplicatorPressureActual	double	The actual force applied by the rear applicator
RearApplicatorSpeedActual	double	The actual linear speed of the rear applicator
RearApplicatorAccelerationActual	double	The actual acceleration of the rear applicator
FrontApplicatorSeparationDistanceActual	double	The actual separation distance between the front applicator and stencil
FrontApplicatorSeparationSpeedActual	double	The actual separation speed of the front applicator from the stencil
FrontApplicatorSeparationAccelerationActual	double	The actual separation acceleration of the front applicator from the stencil
RearApplicatorSeparationDistanceActual	double	The actual separation distance between the rear applicator and stencil
RearApplicatorSeparationSpeedActual	double	The actual separation speed of the rear applicator from the stencil
RearApplicatorSeparationAccelerationActual	double	The actual separation acceleration of the rear applicator from the stencil

ItemSeparationDistanceActual	double	The actual separation distance between the item and stencil
ItemSeparationSpeedActual	double	The actual separation speed of the item from the stencil
ItemSeparationAccelerationActual	double	The actual separation acceleration of the item from the stencil
ItemFiducial1Score	double	The score for item fiducial 1
ItemFiducial2Score	double	The score for item fiducial 2
ItemFiducial3Score	double	The score for item fiducial 3
StencilFiducial1Score	double	The score for stencil fiducial 1
StencilFiducial2Score	double	The score for stencil fiducial 2
StencilFiducial3Score	double	The score for stencil fiducial 3
Temperature	double	The internal temperature of the screen printer
Humidity	double	The internal humidity of the screen printer
CycleTime	double	The time elapsed from a item being received from up-line to the same item being released to down-line.

5.1.4.3 Screen Printing Attributes

Attribute Name	Attribute Type	Description
vendorWarningCode	string	Vendor specific warning code
transitionType	String (enumeration)	Indicates the direction in which a monitoring limit was crossed. LOWERTOUPPER | UPPERTOLOWER
upperDeadBand	double	The upper boundary of the dead band for a monitoring limit
lowerDeadBand	double	The lower boundary of the dead band for a monitoring limit

5.1.5 Screen Printing Dictionary of Nested Elements

5.1.5.1 Element: MonitoringLimitZoneTransition

Description: An element containing the details of a monitoring limit zone transition.

Attribute Name	Attribute Type	Description	Occurrence
nameId	string	Name of the parameter that has crossed the monitoring limit	1-1
transitionType	String (enumeration)	Indicates the direction in which the monitoring limit was crossed. LOWERTOUPPER | UPPERTOLOWER	1-1
upperDeadBand	double	The upper boundary of the dead band for the monitoring limit	0-1
lowerDeadBand	double	The lower boundary of the dead band for the monitoring limit	0-1
Parameter	See 4.4.4	Details of the parameter that has crossed the monitoring limit	0-1

```
<MonitoringLimitZoneTransition
      nameId = "Temperature"
      transitionType = "LOWERTOUPPER"
      upperDeadBand = "51.0"
      lowerDeadBand = "49.0">
      <Parameter
            nameId = "Temperature"
            value = "51.1"
            units = "Celsius"
            minimum = "0.0"
            maximum = "110.0"
      />
</MonitoringLimitZoneTransition>
```

5.1.5.1.1 Monitoring Limit Ids for MonitoringLimitZoneTransition Message

The following table lists the MonitoringLimitZoneTransition name Ids that are applicable to screen printing

nameId	Attribute Type
XAlignment	string
YAlignment	string
ThetaAlignment	string
BoardStretch	string
MaxPrintMediumPresent	string
MinPrintMediumPresent	string
AvgPrintMediumPresent	string
FrontApplicatorPressureActual	string
FrontApplicatorSpeedActual	string

FrontApplicatorAccelerationActual	string
RearApplicatorPressureActual	string
RearApplicatorSpeedActual	string
RearApplicatorAccelerationActual	string
FrontApplicatorSeparationDistanceActual	string
FrontApplicatorSeparationSpeedActual	string
FrontApplicatorSeparationAccelerationActual	string
RearApplicatorSeparationDistanceActual	string
RearApplicatorSeparationSpeedActual	string
RearApplicatorSeparationAccelerationActual	string
ItemSeparationDistanceActual	string
ItemSeparationSpeedActual	string
ItemSeparationAccelerationActual	string
ItemFiducial1Score	string
ItemFiducial2Score	string
ItemFiducial3Score	string
StencilFiducial1Score	string
StencilFiducial2Score	string
StencilFiducial3Score	string
Temperature	string
Humidity	string

5.1.6 Extension to <IPC-2541 EquipmentAlarm> Messages

5.1.6.1 alarmId: SafetyCoverOpen

Description: An alarm generated when the equipment safety covers are opened.

```
<EquipmentAlarm
      dateTime = "2000-02-02T11:33:22.00-05:00"
      alarmId = "SafetyCoverOpen"
      alarmInstanceId = "12345"
      alarmType = "PERSONALSAFETY"
      laneRange = "1"
      zoneRange = "1"
/>
```

5.1.7 Screen Printing Specific Extensions to <IPC-2541 EquipmentError> Messages

5.1.7.1 errorId: EquipmentErrorSubsystem

Screen printer errors that are not process specific will be reported using the 2546 generic EquipmentErrorSubsystem message.

Example of Screen Printing specific EquipmentErrorSubsystem message:

```
<EquipmentError
      dateTime = "2000-02-02T11:39:22.00-05:00"
      errorId = "EquipmentErrorSubsystem"
      errorInstanceId = "12345"
      laneRange = "1"
      zoneRange = "1">
      <Extensions>
            <EquipmentErrorSubsystem>
                  <MachineError
                        vendorErrorCode = "FSPE1234"
                              description = "Pressure error">
                        <Subsystem
                              subsystemType = "PrintApplicator"
                              subsystemId = "FrontApplicator"
                        />
                  </MachineError>
            </EquipmentErrorSubsystem>
      </Extensions>
</EquipmentError>
```

5.1.7.1.1 Printer Subsystem Ids for EquipmentErrorSubsystem Message

subsystemId	Attribute Type
AirSupply	string
Inspection	string
MotionControl	string
PowerSupply	string
PrintApplicator	string
PrintDispenser	string
PrintHead	string
PrintStencil	string
StencilCleaner	string
Table	string
Tooling	string
Transport	string
VacuumGenerator	string

5.1.7.2 errorId: ItemLocationFailure

Description: The printer has failed to align the item with the print stencil.

Attribute Name	Attribute Type	Description	Occurrence
description	string	Human readable description of the failure	1-1
vendorErrorCode	string	Vendor specific error code	0-1
Subsystem	See 4.4.6	Information about a specific subsystem	0-1
Fiducial	See 4.4.2	Information about the specific fiducial	0-1
Parameter nameId = FiducialScore	See 4.4.4	The fiducial score	0-1

```
<EquipmentError
      dateTime = "2000-02-02T11:39:22.00-05:00"
      errorId = "ItemLocationFailure"
      errorInstanceId = "12345"
      laneRange = "1"
      zoneRange = "1">
      <Extensions>
            <ItemLocationFailure
                  description = "Fiducial location failure">
                  <Fiducial
                        designator = "F1"
                        shape = "Circle"
                  />
                  <Parameter
                        nameId = "FiducialScore"
                        value = "50"
                        Minimum = "0"
                        Maximum = "1000"
                        Increment = "1"
                  />
            </ItemLocationFailure>
      </Extensions>
</EquipmentError>
```

5.1.7.3 errorId: InspectionError

Description: An error generated by the inspection process. This may contain a single inspection error, reported during the inspection cycle, or a number of inspection errors listed upon completion of the inspection process.

Attribute Name	Attribute Type	Description	Occurrence
ProcessStepStatus	See IPC2547 Section 4.5	An inspection or measurement step has been executed and a resulting status for the individual step has been determined.	1-n

```
<EquipmentError
      dateTime = "2000-02-02T11:39:22.00-05:00"
      errorId = "InspectionError"
      errorInstanceId = "12345"
      laneRange = "1"
      zoneRange = "1">
      <Extensions>
            <InspectionError>
                  <ProcessStepStatus
                        dateTime = "2000-02-02T11:39:22.00-05:00"
                        itemInstanceId = "1234"
                        sessionRef = "Batch1"
                        itemProcessRef = "2DInspection"
                        processStepId = "1234"
                        status = "FAILED">
                        <RegionOfInterest
                              regionId = "PCB1234-Site-1">
                              <Component designator = "FPGA-1"/>
                        </RegionOfInterest>
                        <Indictment
                              indictmentId
                              = "PCB1234-Site1-MediumOnPad"
                              indictmentKey = "MEDIUM ON PAD ERROR">
                              <MeasurmentRef
                                    PCB1234-Site1-MediumOnPad>
                              </MeasurmentRef>
                        </Indictment>
                        <Measurement
                              measurementId
                              = "PCB1234-Site1-MediumOnPad"
                              measurementType = "MediumOnPad">
                              <MeasuredNumeric
                                    value = "50.0"
                                    units = "Percent"
                              />
                              <ExpectedNumeric
                                    minimum = "70.0"
                                    units = "Percent"
                              />
                        </Measurement>
                  </ProcessStepStatus>
            </InspectionError>
      </Extensions>
</EquipmentError>
```

5.1.7.4 errorId: MonitoringLimitZoneTransition

Description: Error event to indicate when the value of an equipment parameter crosses a pre-defined error limit.

```
<EquipmentError
      dateTime = "2000-02-02T11:51:22.00-05:00"
      errorId = "MonitoringLimitZoneTransition"
      errorInstanceId = "12345"
      laneRange = "1"
      zoneRange = "1">
      <Extensions>
            <MonitoringLimitZoneTransition
                  nameId = "Temperature"
                  transitionType = "LowerToUpper"
                  upperDeadBand = "51.0"
                  lowerDeadBand = "49.0">
                  <Parameter
                        nameId = "Temperature"
                        value = "51.1"
                        units = "Celsius"
                        minimum = "0.0"
                        maximum = "110.0"
                  />
            </MonitoringLimitZoneTransition>
      </Extensions>
</EquipmentError>
```

5.1.8 Extensions to <IPC-2541 EquipmentWarning> Messages

Unless otherwise specified all of the Screen Printing specific EquipmentWarning messages use the following structure.

Attribute Name	Attribute Type	Description	Occurrence
description	string	Human readable description of the warning	1-1
vendorWarningCode	string	Vendor specific warning code	0-1
Subsystem	See 4.4.6	Information about the specific subsystem	0-1

Any EquipmentWarning messages that deviate from the above structure will be explicitly defined in the relevant message section.

Example of Screen Printing specific EquipmentWarning message:

```
<EquipmentWarning
      dateTime = "2000-02-02T11:39:22.00-05:00"
      warningId = "PrinterConsumableExpired"
      warningInstanceId = "12345"
      laneRange = "1"
      zoneRange = "1">
      <Extensions>
            <PrinterConsumableExpired
                  description = "Solder paste cartridge empty"
                  vendorWarningCode = "SPCE">
```

```
                 <Subsystem
                       subsystemType = "PrintDispenser"
                       subsystemId = "Dispenser1"
                 />
           </PrinterConsumableExpired>
     </Extensions>
</EquipmentWarning>
```

5.1.8.1 warningId: PrinterConsumableExpired

Description: A warning specific to printer consumables.

5.1.8.2 warningId: PrinterConsumableLow

Description: A warning specific to printer consumables.

5.1.8.3 warningId: MonitoringLimitZoneTransition

Description: Warning event to indicate when the value of an equipment parameter crosses a pre-defined warning limit.

```
<EquipmentWarning
     dateTime = "2000-02-02T11:51:22.00-05:00"
     warningId = "MonitoringLimitZoneTransition"
     warningInstanceId = "12345"
     laneRange = "1"
     zoneRange = "1">
     <Extensions>
           <MonitoringLimitZoneTransition
                 nameId = "Temperature"
                 transitionType = "LowerToUpper"
                 upperDeadBand = "51.0"
                 lowerDeadBand = "49.0">
                 <Parameter
                       nameId = "Temperature"
                       value = "51.1"
                       units = "Celsius"
                       minimum = "0.0"
                       maximum = "110.0"
                 />
           </MonitoringLimitZoneTransition>
     </Extensions>
</EquipmentWarning>
```

5.1.8.4 warningId: InspectionWarning

Description: A warning generated by the Screen Printer inspection system. This may contain a single inspection warning reported during the inspection process or a series of inspection warnings listed once the inspection process is complete.

Attribute Name	Attribute Type	Description	Occurrence
ProcessStepStatus	See IPC-2547 Section 4.5	An inspection or measurement step has been executed and a resulting status for the individual step has been determined.	1-n

```
<EquipmentWarning
      dateTime = "2000-02-02T11:39:22.00-05:00"
      warningId = "InspectionWarning"
      warningInstanceId = "12345"
      laneRange = "1"
      zoneRange = "1">
      <Extensions>
            <InspectionWarning>
                  <ProcessStepStatus
                        dateTime = "2000-02-02T11:39:22.00-05:00"
                        itemInstanceId = "1234"
                        sessionRef = "1234"
                        itemProcessRef = "2DInspection"
                        processStepId = "1234"
                        status = "PASSED">
                        <RegionOfInterest
                              regionId = "PCB1234-Site-1">
                              <Component designator = "FPGA-1"/>
                        </RegionOfInterest>
                        <Indictment
                              indictmentId
                              = "PCB1234-Site1-MediumOnPad"
                              indictmentKey
                              = "MEDIUM ON PAD WARNING">
                              <MeasurmentRef>
                                    PCB1234-Site1-MediumOnPad
                              </MeasurmentRef>
                        </Indictment>
                        <Measurement
                              measurementId
                              = "PCB1234-Site1-MediumOnPad"
                              measurementType = "MediumOnPad">
                              <MeasuredNumeric
                                    value = "50.0"
                                    units = "Percent"
                              />
                              <ExpectedNumeric
                                    minimum = "70.0"
                                    units = "Percent"
                              />
                        </Measurement>
                  </ProcessStepStatus>
            </InspectionWarning>
```

```
      </Extensions>
</EquipmentWarning>
```

5.1.9 Extension to <IPC-2541 EquipmentInformation> Messages

Unless otherwise specified all of the Screen Printing specific EquipmentInformation messages use the following structure.

Attribute Name	Attribute Type	Description	Occurrence
description	string	Human readable description of the information	1-1
Subsystem	See 4.4.6	Information about the specific subsystem	0-1

Any EquipmentInformation messages that deviate from the above structure will be explicitly defined in the relevant message section.

Example of Screen Printing specific EquipmentInformation message:

```
<EquipmentInformation
      dateTime = "2000-02-02T11:51:22.00-05:00"
      informationId = "AlignmentStart"
      laneRange = "1"
      zoneRange = "1">
      <Extensions>
            <AlignmentStart
                  description = "Stencil item alignment started">
                  <Subsystem
                        subsystemType = "PrintStencil"
                        subsystemId = "Stencil1"
                  />
            </AlignmentStart>
      </Extensions>
</EquipmentInformation>
```

5.1.9.1 informationId: AlignmentStart

Description: Information event to indicate that alignment has started.

5.1.9.2 informationId: AlignmentComplete

Description: Information event to indicate that alignment is complete.

Attribute Name	Attribute Type	Description	Occurrence
description	string	Human readable description of the information	1-1
Subsystem	See 4.4.6	Information about the specific subsystem	0-1
Parameter nameId = XAlignment	See 4.4.4	The linear movement required in the X direction to align the item with the print stencil	0-1
Parameter nameId = YAlignment	See 4.4.4	The linear movement required in the Y direction to align the item with the print stencil	0-1
Parameter nameId = ThetaAlignment	See 4.4.4	The rotational movement required in the Theta direction to align the item with the print stencil	0-1

```
<EquipmentInformation
      dateTime = "2000-02-02T11:51:22.00-05:00"
      informationId = "AlignmentComplete"
      laneRange = "1"
      zoneRange = "1">
      <Extensions>
            <AlignmentComplete
                  description = "Stencil item alignment complete">
                  <Subsystem
                        subsystemType = "PrintStencil"
                        subsystemId = "Stencil1"
                  />
                  <Parameter
                        nameId = "XAlignment"
                        value = "0.1"
                        units = "mm"
                  />
                  <Parameter
                        nameId = "YAlignment"
                        value = "0.1"
                        units = "mm"
                  />
                  <Parameter
                        nameId = "ThetaAlignment"
                        value = "1.0"
                        units = "ArcSeconds"
                  />
            </AlignmentComplete>
      </Extensions>
</EquipmentInformation>
```

5.1.9.3 informationId: CleaningCycleStart

Description: Information event to indicate that the cleaning cycle has started.

5.1.9.4 informationId: CleaningCycleComplete

Description: Information event to indicate that the cleaning cycle is complete.

5.1.9.5 informationId: InspectionStart

Description: Information event to indicate that the inspection cycle has started.

5.1.9.6 informationId: InspectionComplete

Description: Information event to indicate that the inspection cycle is complete.

Attribute Name	Attribute Type	Description	Occurrence
ItemProcessStatus	See IPC-2547 Section 4.4	Processing of an item has completed, and the process task issues an overall status for the processed item	1-1

```
<EquipmentInformation
      dateTime = "2000-02-02T11:51:22.00-05:00"
      informationId = "InspectionComplete"
      laneRange = "1"
      zoneRange = "1">
      <Extensions>
            <InspectionComplete>
                  <ItemProcessStatus
                        dateTime = "2000-02-02T11:51:22.00-05:00"
                        itemInstanceId = "1234"
                        sessionRef = "Batch1"
                        itemProcessId = "2DInspection"
                        status = "PASSED"
                        comment = "Inspection complete with warnings"
                  />
            </InspectionComplete>
      </Extensions>
</EquipmentInformation>
```

5.1.9.7 informationId: PrintCycleStart

Description: Information event to indicate that the print cycle has started.

5.1.9.8 informationId: PrintCycleComplete

Description: Information event to indicate that the print cycle is complete.

5.1.9.9 informationId: PrintMediumConditioningStart

Description: Information event to indicate that the print medium conditioning has started.

5.1.9.10 informationId: PrintMediumConditioningComplete

Description: Information event to indicate that the print medium conditioning is complete.

5.1.9.11 informationId: PrintMediumDispenseStart

Description: Information event to indicate that the print medium dispense has started.

5.1.9.12 informationId: PrintMediumDispenseComplete

Description: Information event to indicate that the print medium dispense is complete.

5.1.9.13 informationId: StencilLoaded

Description: Information event to indicate that the print stencil has been loaded.

5.1.9.14 informationId: StencilUnloaded

Description: Information event to indicate that the print stencil has been un-loaded.

5.1.9.15 informationId: ToolChangeStart

Description: Information event to indicate that the tool change has started.

5.1.9.16 informationId: ToolChangeComplete

Description: Information event to indicate that the tool change is complete.

5.1.9.17 informationId: MonitoringLimitZoneTransition

Description: Information event to indicate when the value of an equipment parameter crosses a pre-defined monitoring limit.

```
<EquipmentInformation
      dateTime = "2000-02-02T11:51:22.00-05:00"
      informationId = "MonitoringLimitZoneTransition"
      laneRange = "1"
      zoneRange = "1">
      <Extensions>
            <MonitoringLimitZoneTransition
                  nameId = "Temperature"
                  transitionType = "LowerToUpper"
                  upperDeadBand = "51.0"
                  lowerDeadBand = "49.0">
                  <Parameter
                        nameId = "Temperature"
                        value = "51.1"
                        units = "Celsius"
                        minimum = "0.0"
                        maximum = "110.0"
                  />
            </MonitoringLimitZoneTransition>
      </Extensions>
</EquipmentInformation>
```

5.1.10 Extension to <IPC-2541 ItemInformation> Messages

5.1.10.1 informationId: ProcessDataReport

Description: A report containing process data specific to the current item

Attribute Name	Attribute Type	Description	Occurrence
nameId	string	Name of process data report	1-1
Parameter nameId = XAlignment	See 4.4.4	The linear movement required in the X direction to align the item with the print stencil	0-1
Parameter nameId = YAlignment	See 4.4.4	The linear movement required in the Y direction to align the item with the print stencil	0-1
Parameter nameId = ThetaAlignment	See 4.4.4	The rotational movement required in the Theta direction to align the item with the print stencil	0-1
Parameter nameId = BoardStretch	See 4.4.4	The difference in fiducial separation on the item versus the difference in fiducial separation on the print stencil	0-1
Parameter nameId = MaxPrintMediumPresent	See 4.4.4	The maximum print medium present reported by the inspection system	0-1
Parameter nameId = AvgPrintMediumPresent	See 4.4.4	The average print medium present reported by the inspection system	0-1
Parameter nameId = MinPrintMediumPresent	See 4.4.4	The minimum print medium present reported by the inspection system	0-1
Parameter nameId = FrontApplicatorPressureActual	See 4.4.4	The actual force applied by the front applicator	0-1
Parameter nameId = FrontApplicatorSpeedActual	See 4.4.4	The actual linear speed of the front applicator	0-1
Parameter nameId = FrontApplicatorAccelerationActual	See 4.4.4	The actual acceleration of the front applicator	0-1
Parameter nameId = RearApplicatorPressureActual	See 4.4.4	The actual force applied by the rear applicator	0-1
Parameter nameId = RearApplicatorSpeedActual	See 4.4.4	The actual linear speed of the rear applicator	0-1
Parameter nameId = RearApplicatorAccelerationActual	See 4.4.4	The actual acceleration of the rear applicator	0-1
Parameter nameId = FrontApplicatorSeparationDistanceActual	See 4.4.4	The actual separation distance between the front applicator and stencil	0-1
Parameter nameId = FrontApplicatorSeparationSpeedActual	See 4.4.4	The actual separation speed of the front applicator from the stencil	0-1

Parameter nameId = FrontApplicatorSeparationAccelerationActual	See 4.4.4	The actual separation acceleration of the front applicator from the stencil	0-1
Parameter nameId = RearApplicatorSeparationDistanceActual	See 4.4.4	The actual separation distance between the rear applicator and stencil	0-1
Parameter nameId = RearApplicatorSeparationSpeedActual	See 4.4.4	The actual separation speed of the rear applicator from the stencil	0-1
Parameter nameId = RearApplicatorSeparationAccelerationActual	See 4.4.4	The actual separation acceleration of the rear applicator from the stencil	0-1
Parameter nameId = ItemSeparationDistanceActual	See 4.4.4	The actual separation distance between the item and stencil	0-1
Parameter nameId = ItemSeparationSpeedActual	See 4.4.4	The actual separation speed of the item from the stencil	0-1
Parameter nameId = ItemSeparationAccelerationActual	See 4.4.4	The actual separation acceleration of the item from the stencil	0-1
Parameter nameId = ItemFiducial1Score	See 4.4.4	The score for item fiducial 1	0-1
Parameter nameId = ItemFiducial2Score	See 4.4.4	The score for item fiducial 2	0-1
Parameter nameId = ItemFiducial3Score	See 4.4.4	The score for item fiducial 3	0-1
Parameter nameId = StencilFiducial1Score	See 4.4.4	The score for stencil fiducial 1	0-1
Parameter nameId = StencilFiducial2Score	See 4.4.4	The score for stencil fiducial 2	0-1
Parameter nameId = StencilFiducial3Score	See 4.4.4	The score for stencil fiducial 3	0-1
Parameter nameId = Temperature	See 4.4.4	The internal temperature of the screen printer	0-1
Parameter nameId = Humidity	See 4.4.4	The internal humidity of the screen printer	0-1
Parameter nameId = CycleTime	See 4.4.4	The time elapsed from a item being received from up-line to the same item being released to down-line.	0-1

```
<ItemInformation
      dateTime = "2000-02-02T11:51:22.00-05:00"
      informationId = "ProcessDataReport">
      <Extensions>
            <ProcessDataReport
                  nameId = "ScreenPrinterReport1">
                  <Parameter
                        nameId = "XAlignment"
                        value = "0.1"
                        units = "mm"
                  />
                  <Parameter
                        nameId = "YAlignment"
                        value = "0.1"
                        units = "mm"
                  />
```

```
<Parameter
      nameId = "ThetaAlignament"
      value = "1.0"
      units = "radian"
/>
<Parameter
      nameId = "BoardStretch"
      value = "0.5"
      units = "mm"
/>
<Parameter
      nameId = "MaxPrintMediumPresent"
      value = "90"
      units = "percent"
/>
<Parameter
      nameId = "MinPrintMediumPresent"
      value = "80"
      units = "percent"
/>
<Parameter
      nameId = "AvgPrintMediumPresent"
      value = "85"
      units = "percent"
/>
<Parameter
      nameId = "FrontApplicatorSpeedActual"
      value = "10.0"
      units = "mm/s"
/>
<Parameter
      nameId = "RearApplicatorSpeedActual"
      value = "10.0"
      units = "mm/s"
/>
<Parameter
      nameId = "FrontApplicatorPressureActual"
      value = "5.0"
      units = "kg"
/>
<Parameter
      nameId = "RearApplicatorPressureActual"
      value = "5.0"
      units = "kg"
/>
<Parameter
      nameId = "Temperature"
      value = "25.5"
      units = "Celsius"
/>
<Parameter
      nameId = "RelativeHumidity"
      value = "50.1"
      units = "Percent"
/>
<Parameter
      nameId = "CycleTime"
```

```
                        value = "25"
                        units = "seconds"
                  />
            </ProcessDataReport>
      </Extensions>
</ItemInformation>
```

5.2 Specific Adhesive Dispensing Equipment Events and Message Formats (Dispense)

Under Consideration

5.3 Specific Manual Placement Equipment Events and Message Formats (Manual)

Under Consideration

5.4 Specific Reflow Equipment Events and Message Formats (Reflow)

Under Consideration

5.5 Specific Pick and Place Equipment Events and Message Formats (Place)

This section pertains to automated surface mount pick and place equipment, including turret style chipshooters and fine pitch placement equipment.

5.5.1 Dictionary of Common Terms

Component Supply
A device to supply the equipment with components, which have to be placed. This is a term, which should cover all existing technologies like feeders or matrix tray changer.

Component Supply Area
A unique area of component supplies (i.e. left right front back) found on the machine

Feeder
Component Supply, which feeds the head with components out of tapes or bulk cases.

FeederId
This is a unique serial number associated with a feeder.

Feeder Table
A changeable group of slots that has the capacity to hold feeders. These are usually filled off-line and changed in mass when needed.

Feeder Type
A type of feeder.

Feeder Track
Unique location of the feeder in a component supply area

Feeder Division
Unique location within a feeder.

Head
Unit which is picking and placing the components. Each head can contain several nozzle segments, which hold a nozzle to pick and place the component.

Head Group
A Head Group is holding one or more heads, which are moved together in the machine.

MaterialCuttingArea
The area that cuts the excess material used for holding components. This area usually cuts the excess tape that on a pick and place machine.

Nozzle
Changeable part on the head to pick up all the different shapes of components.

Nozzle Changer
This is a holding bin for Nozzle Changer Sections. This is a physical location on the machine.

Nozzle Changer Section
A holding section for a group of nozzles to be used at a latter time.

Nozzle Changer Division
This is a location within the Nozzle Changer Section.

Nozzle Segment
Fixed Location of a changeable nozzle on a head.

Tray Server
A tray server is holding trays to supply the machine with components delivered in trays.

Tray Tower
A Tray server can hold one or more towers, which is a stack of trays.

Tray
Unit of delivery for components to a tray server

Tray Location
Location of a tray in a tray tower.

Tray Section
One tray can contain several sections with different types of components

Tray Division
A Tray Section is divided into several Tray Divisions. Each Division holds one component during delivery

5.5.2 Model of Equipment

The objective of the model of the pick and place machine (see Figure 6) is to define a common terminology to name the subsystems in all machines. This might be useful to have a consistent naming for all vendors, although each vendor might have different definitions for the same kind of subsystem.

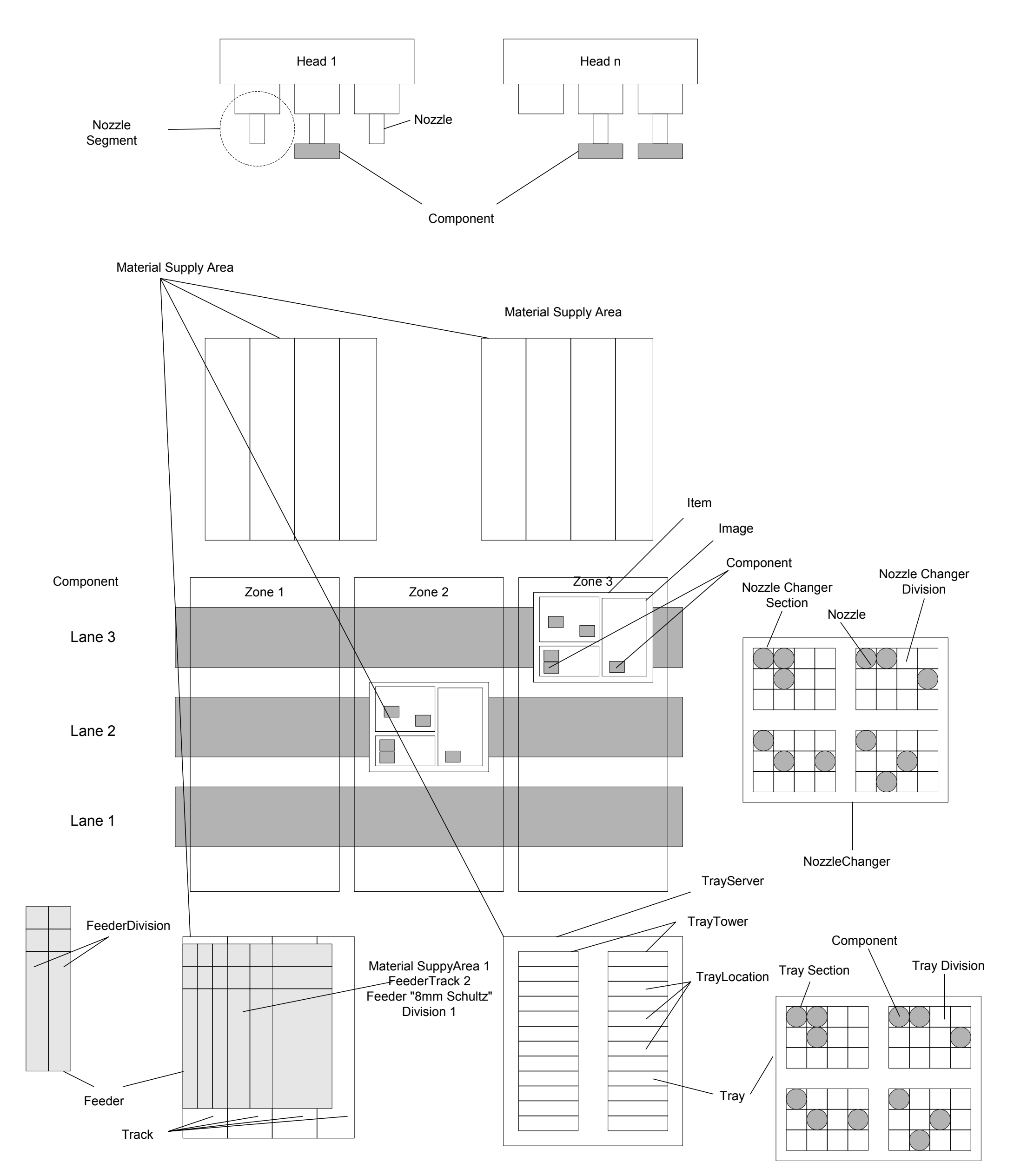


Figure 6 Abstract model of the equipment

5.5.3 Dictionary of Attributes

Attribute Name	Attribute Type	Description
componentId	string	Unique component identifier
materialSupplyArea	string	Unique area of material (i.e. component) supplies found on the machine
decrementMisPickCount	1…n	Most pick & place equipment detect an empty MaterialHandler by counting pickup warnings on one specific MaterialHandler. When sending a MaterialHandlerOutOfComponents message this attribute can be used to decrement the count of Pickup Errors charged to the Material Handler by the appropriate number. The will allow the host system to correct the number of warnings for this materialHandler. For example if 3 MisPick warnings were sent to the host which turned out to be an OutOfComponent error then a 3 would be entered in this attribute.
estimatedTimeTillEndOfComponents	timeDuration	Estimated time till end of components in seconds.
feederType	string	A specific type of a feeder
feederDivision	string	Unique location within a feeder
headId	string	Head name
itemInstanceId	string	Unique identification
materialHandlerType	string (enumeration)	A type of material handler: FEEDER | TRAYSERVER
materialHandlerTableId	string	Unique identification of a specific materialHandler table
nozzleChanger	string	Nozzle changer location
nozzleChangerSection	string	Nozzle changer section in a nozzle changer
nozzleChangerDivision	string	Nozzle changer division located in a nozzle changer
nozzleSegmentId	string	Fixed location of a changeable nozzle on a head
nozzleType	string	Type of Nozzle
numberOfComponentsLeft	positiveInteger	Number of components left for consumption.
package	string (enumeration)	See GenCAM (IPC-2511) package enumerations
partId	string	Unique part identification such as a serial number.
rejectLocation	string	The location where a component is rejected
trackId	1..n	Unique location on the machine. Sometimes referred to as slot.
trayServerType	string	A type of tray server
trayServerTower	1..n	Tray server tower number
trayServerLocation	1..n	Tray server location number
traySection	string	Tray section
trayDivision	string	Tray division

5.5.4 Dictionary of Nested Elements

5.5.4.1 Element: Component

Description: Information about a specific component package.

Attribute Name	Attribute Type	Description	Occurrence
componentId	string	Unique component identifier	1-1
designator	string	Identifies a unique location on the board.	0-1
imageId	string	The IPC-2510 Image. This is typically a single circuit in the panel array	0-1
recognitionReference	string	Reference name used by the recognition system and/or the recipe.	0-1
partId	string	Part identification such as a serial number.	0-1
package	string (enumeration)	See GenCAM (IPC-2511) package enumerations	0-1

```
<Component
      componentId="SOIC-16"
      designator="S100"
      imageId="2"
      recognitionReference="S100.gf"
      partId="AZ266533E5Z"
      package="SOIC 16"
/>
```

5.5.4.2 Element: ComponentValidation

Description: Information about a specific batch/lot of components. This would be used at the instance of validation of a batch/lot.

Attribute Name	Attribute Type	Description	Occurrence
componentId	string	Unique component identifier	1-1
partId	string	Part identification such as a serial number.	0-1
package	string (enumeration)	See GenCAM (IPC-2511) package enumerations	0-1

```
<ComponentValidation
      componentId="SOIC-16"
      partId="4001-300-G0402-Sally-7220-6543321"
      package="SOIC 16"
/>
```

5.5.4.3 Element: Nozzle

Description: Information about a specific nozzle located on a head.

Attribute Name	Attribute Type	Description	Occurrence
nozzleType	string	Type of Nozzle	1-1
headId	string	Head name	1-1
nozzleSegmentId	string	Fixed location of a changeable nozzle on a head	1-1
partId	string	The location where a component is rejected	0-1

```
<Nozzle
      nozzleType="912"
      headId="1"
      nozzleSegmentId="2"
      partId="123456"
/>
```

5.5.4.4 Element: NozzleChangerLocation

Description: Information about a specific location in the nozzlechanger.

Attribute Name	Attribute Type	Description	Occurrence
nozzleType	string	Type of Nozzle	1-1
nozzleChanger	string	Nozzle changer location	1-1
nozzleChangerDivision	string	Nozzle changer division located in a nozzle changer	1-1
nozzleChangerSection	string	Nozzle changer section in a nozzle changer	0-1
partId	string	Unique part identification such as a serial number.	0-1

```
<NozzleChangerLocation
      nozzleType="912"
      nozzleChanger="1"
      nozzleChangerDivision="4"
      nozzleChangerSection="2"
/>
```

5.5.4.5 Element: MaterialHandler

Description: Information about a specific material handler (i.e. materialHandler, tray server). Usually a component is presented to the machine using either a feeder or a tray server. The attributes associated with a feeder would be used if the component is located on a feeder component supply area and the attributes associated with a tray would be used if the component is located on a tray server.

Attribute Name	Attribute Type	Description	Occurrence
materialSupplyArea	string	Unique area of material (i.e. component) supplies found on the machine	1-1
trackId	1..n	Unique location on the machine. Sometimes referred to as slot.	1-1
materialHandlerType	string (enumeration)	A type of material handler: FEEDER | TRAYSERVER	1-1
feederType	string	A specific type of a feeder	1-1
feederDivision	string	Unique location within a feeder	1-1
trayServerType	string	A type of tray server	1-1*
trayServerTower	1..n	Tray server tower number	1-1*
trayServerLocation	1..n	Tray server location number	1-1*
traySection	string	Tray section	1-1*
trayDivision	string	Tray division	0-1
partId	string	Unique part identification such as a serial number.	0-1
materialHandlerTableId	string	Unique identification of a specific materialHandler table	0-1

* Mandatory only if materialHandlerType is TRAYSERVER

```
<MaterialHandler
      materialSupplyArea="Front"
      trackId=4
      materialHandlerType="FEEDER"
      feederType="8mm Tape"
      feederDivision="2"
/>
```

5.5.5 Extensions to IPC-2541 Mandatory Messages

IPC-2541 <EquipmentError> Message

5.5.5.1 ErrorId: EquipmentOutOfComponent

Definition: The machine cannot continue processing because there are no materialHandlers available with this component.

Element Name	Element Type	Description	Occurrence
Component	See 5.5.4.1	Information about a specific component package	1-1

```
<EquipmentOutOfComponent>
      <Component
            componentId="SOIC-8"
            package="SOIC 8"
      />
</EquipmentOutOfComponent>
```

5.5.5.2 ErrorId: EquipmentErrorSubsystem

Definition: The machine detects an error in one of its subsystems and therefore can not continue processing.

Element Name	Element Type	Description	Occurrence
MachineError	See 4.4.3	Information about an error in the machine	1-1

```
<EquipmentErrorSubsystem>
      <MachineError>
            vendorErrorCode="St2947-ab12"
            description=="Scanneris malfunctioning"
            <Subsystem
                  subsystemType="Scanner"
                  subsystemId="Lane 1: input area"
            />
      </MachineError>
</EquipmentErrorSubsystem>
```

5.5.6 IPC-2541 <EquipmentWarning> Messages

5.5.6.1 WarningId: ItemRecognitionFailure

Definition: A recognition failure pertaining to an item.

warningTypes:

MissingFiducial | BadMeasurement

MissingFiducial: Fiducial is not recognized on location defined in recipe |

BadMeasurement: Quality of the fiducial measurement is not good enough

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
warningType	string	Describes the type of warning.	1-1
itemInstanceId	string	Unique identification	1-1
Fiducial	See 4.4.2	Information about a specific fiducial	1-1
Subsystem	See 4.4.6	Information about a specific Subsystem	0-1
Recipe	See 4.4.5	Identifies the recipe, program or algorithm	0-1

```
<ItemRecognitionFailure
      warningType="MissingFiducial"
      itemInstanceId="668VCR255">
      <Fiducial
            designator="F1"
            imageId="4"
            imageShape="Rectangle"
            recognitionReference="123.gf"
      />
      <Subsystem
            subsystemType="Medium Resolution Camera"
            subsystemId="Downward looking: Head1"
            revision="3.4"
      />
      <Recipe
            name="VCR-2912"
            revision="4"
            zoneRange="1,2"
            laneRange="1,2"
      />
</ItemRecognitionFailure>
```

5.5.6.2 WarningId: ItemDidNotTransferSuccessfully

Definition: This is an indication that the item was transferred into or within the equipment and never made it successfully to its destination.

warningTypes:

TimeOut | Jam

TimeOut: The item did not arrive at location in expected period of time

Jam: Item was not able to transfer. It is still detected at the starting location.

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
warningType	string	Describes the type of warning.	1-1
Recipe	See 4.4.5	Identifies the recipe, program or algorithm	0-1
itemInstanceId	string	Unique identification	0-1

```
<ItemDidNotTransferSuccessfully
      warningType="TimeOut"
      itemInstanceId="0002">
      <Recipe
            recipeId="VCR-2912"
            revision="4"
      />
</ItemDidNotTransferSuccessfully>
```

5.5.6.3 WarningId: MaterialHandlerLow

Definition: The materialHandler is almost out of components.

warningTypes:

MeasuredMaterialHandlerLow | EstimatedMaterialHandlerLow

MeasuredMaterialHandlerLow: The equipment knows exactly how many components are in the component supply

EstimatedMaterialHandlerLow: The equipment is estimating how many components are in the component supply

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
warningType	string	Describes the type of warning.	1-1
MaterialHandler	See 5.5.4.5	Information about a specific material handler (i.e. materialHandler, tray server).	1-1
estimatedTimeTillEndOfComponents	timeDuration	Estimated time till end of components in seconds.	0-1
numberOfComponentsLeft	positiveInteger	Number of components left for consumption.	0-1
Component	See 5.5.4.1	Information about a specific component package.	0-1

```
<MaterialHandlerLow
      warningId="EstimatedMaterialHandlerLow"
      estimatedTimeTillEndOfComponents=123
      numberOfComponentsLeft=55>
      <MaterialHandler
            materialSupplyArea="Front"
            trackId=3
            materialHandlerType="FEEDER"
            feederType="8mm Tape"
            feederDivision="2"
      />
</MaterialHandlerLow>
```

5.5.6.4 WarningId: MaterialHandlerInstalled

Definition: The materialHandler is placed on the machine.

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
MaterialHandler	See 5.5.4.5	Information about a specific material handler (i.e. materialHandler, tray server).	1-1
messageInitiator	enumerated string	A description of how this message was initiated. OPERATOR | HOST | AUTOMATIC.	0-1
Component	See 5.5.4.1	Information about a specific component package.	0-1

```
<MaterialHandlerInstalled
      messageInitiator="OPERATOR">
      <MaterialHandler
            materialSupplyArea="Front"
            trackId=3
            materialHandlerType="FEEDER"
            feederType="8mm Tape"
            feederDivision="2"
      />
</MaterialHandlerInstalled>
```

5.5.6.5 WarningId: MaterialHandlerUninstalled

Definition: The materialHandler has been removed from the machine.

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
MaterialHandler	See 5.5.4.5	Information about a specific material handler (i.e. materialHandler, tray server).	1-1
messageInitiator	enumerated string	A description of how this message was initiated. OPERATOR | HOST | AUTOMATIC.	0-1
Component	See 5.5.4.1	Information about a specific component package.	0-1

```
<MaterialHandlerUninstalled
      messageInitiator="OPERATOR">
      <MaterialHandler
            materialSupplyArea="Front"
            trackId=3
            materialHandlerType="FEEDER"
            feederType="8mm Tape"
            feederDivision="2"
      />
</MaterialHandlerUninstalled>
```

5.5.6.6 WarningId: MaterialHandlerDivisionDown

Definition: The division of a materialHandler is not available. The reason is not determined yet. It could be followed by a MaterialHandlerOutOfComponent or MaterialHandlerTrouble. This could be preceded by MaterialHandlerUninstalled.

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
MaterialHandler	See 5.5.4.5	Information about a specific material handler (i.e. materialHandler, tray server).	1-1
messageInitiator	enumerated string	A description of how this message was initiated. OPERATOR | HOST | AUTOMATIC.	0-1
Component	See 5.5.4.1	Information about a specific component package.	0-1

```
<MaterialHandlerDivisionDown>
      <MaterialHandler
            materialSupplyArea="Front"
            trackId=3
            materialHandlerType="FEEDER"
            feederType="8mm Tape"
            feederDivision="2"
      />
</MaterialHandlerDivisionDown>
```

5.5.6.7 WarningId: MaterialHandlerTrouble

Definition: This event occurs when the equipment has tried to pick a component out of a materialHandler and it has been determined that the materialHandler is not out of components. One possible reason might be jam of the tape.

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
MaterialHandler	See 5.5.4.5	Information about a specific material handler (i.e. materialHandler, tray server).	1-1
messageInitiator	enumerated string	A description of how this message was initiated. OPERATOR | HOST | AUTOMATIC.	0-1
Component	See 5.5.4.1	Information about a specific component package.	0-1

```
<MaterialHandlerTrouble>
     <MaterialHandler
          materialSupplyArea="Front"
          trackId=3
          materialHandlerType="FEEDER"
          feederType="8mm Tape"
          feederDivision="2"
     />
</MaterialHandlerTrouble>
```

5.5.6.8 WarningId: MaterialHandlerOutOfComponent

Definition: The materialHandler is determined to be out of components.

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
MaterialHandler	See 5.5.4.5	Information about a specific material handler (i.e. materialHandler, tray server).	1-1
Component	See 5.5.4.1	Information about a specific component package.	1-1
DecrementMispickCount	1…n	Most pick & place equipment detect an empty MaterialHandler by counting pickup warnings on one specific MaterialHandler. When sending a MaterialHandlerOutOfComponents message this attribute can be used to decrement the count of Pickup Errors charged to the Material Handler by the appropriate number. The will allow the host system to correct the number of warnings for this materialHandler. For example if 3 MisPick warnings were sent to the host which turned out to be an OutOfComponent error then a 3 would be entered in this attribute.	0-1

```
<MaterialHandlerOutOfComponents
     decrementMisPickCount=3>
     <MaterialHandler
          materialSupplyArea="Front"
```

```
                trackId=3
                materialHandlerType="FEEDER"
                feederType="8mm Tape"
                feederDivision="2"
          />
          <Component
                componentId="SOIC-16"
                partId="AZ266533E5Z"
          />
    </MaterialHandlerOutOfComponents>
```

5.5.7 IPC-2541 <EquipmentInformation> Messages

5.5.7.1 InformationId: ComponentMissPick

Definition: This is an indication that the component was not properly picked up from a feeding device.

informationTypes:

MissingOnNozzle | MissAlignedComponent

MissingOnNozzle: Component is completely missing from the nozzle

MissAlignedComponent: Recognition system not able to correct alignment. This could be because of the following reasons: misaligned (X,Y, Theta), (please add anymore that could come up.)

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
informationType	string	Describes the type of information message.	1-1
Nozzle	See 5.5.4.3	Information about a specific nozzle located on a head	1-1
MaterialHandler	See 5.5.4.5	Information about a specific material handler (i.e. materialHandler, tray server).	1-1
Component	See 5.5.4.1	Information about a specific component package.	1-1
Recipe	See 4.4.5	Identifies the recipe, program or algorithm	0-1

```
    <ComponentMisPick
          informationType="MissingOnNozzle">
          <Nozzle
                nozzleType="912"
                headId="1"
                nozzleSegmentId="2"
          />
          <MaterialHandler
                materialSupplyArea="Front"
                trackId=3
                materialHandlerType="FEEDER"
                feederType="8mm Tape"
                feederDivision="2"
```

```
        />
        <Component
              componentId="SOIC-16"
              partId="AZ266533E5Z"
        />
  </ComponentMisPick>
```

5.5.7.2 InformationId: ComponentNotPlaced

Definition: This is an indication that the component was lost between pick and place. This could occur when a component is picked up correctly, the recognition system detects it correctly however the component is not placed on the board.

informationTypes:

LostDuringMovement

LostDuringMovement: Component is getting lost from the nozzle after component recognition

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
informationType	string	Describes the type of information message.	1-1
Nozzle	See 5.5.4.3	Information about a specific nozzle located on a head	1-1
MaterialHandler	See 5.5.4.5	Information about a specific material handler (i.e. materialHandler, tray server).	1-1
Component	See 5.5.4.1	Information about a specific component package.	1-1
Recipe	See 4.4.5	Identifies the recipe, program or algorithm	0-1

```
  <ComponentNotPlaced
        informationType="LostDuringMovement">
        <Nozzle
              nozzleType="912"
              headId="1"
              nozzleSegmentId="2"
        />
        <MaterialHandler
              materialSupplyArea="Front"
              trackId=3
              materialHandlerType="FEEDER"
              feederType="8mm Tape"
              feederDivision="2"
        />
        <Component
              componentId="SOIC-16"
              partId="AZ266533E5Z"
        />
  </ComponentNotPlaced>
```

5.5.7.3 InformationId: MaterialHandlerChanged

Definition: This is an indication that new material has been placed on the machine. i.e. MaterialHandler refilled.

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
MaterialHandler	See 5.5.4.5	Information about a specific material handler (i.e. materialHandler, tray server).	1-1
Component	See 5.5.4.1	Information about a specific component package	1-1
ComponentValidation	See 5.5.4.2	Information about a specific batch/lot of components	0-1
messageInitiator	enumerated string	A description of how this message was initiated. OPERATOR | HOST | AUTOMATIC.	0-1

```
<MaterialHandlerChanged
      messageInitiator="OPERATOR">
      <MaterialHandler
            materialSupplyArea="Front"
            trackId=3
            materialHandlerType="FEEDER"
            feederType="8mm Tape"
            feederDivision="2"
      />
      <Component
            componentId="SOIC-16"
            partId="AZ266533E5Z"
      />
      <ComponentValidation
            componentId="SOIC-16"
            partId="73829-2329g-ADSJ-9999"
            package="SOIC 16"
      />
</MaterialHandlerChanged>
```

5.5.7.4 InformationId: ComponentNotRecognized

Definition: A component was not recognized therefore was not placed on an item.

informationTypes:

MissingLead | LeadOutOfTolerance | Coplanarity | BadSize

MissingLead: One of the component leads is missing

LeadOutOfTolerance: Size does not meet tolerance

Coplanarity: Coplanarity check failed

BadSize: Size of the component is incorrect

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
InformationType	string	Describes the type of information message.	1-1
Nozzle	See 5.5.4.3	Information about a specific nozzle located on a head	1-1
Component	See 5.5.4.1	Information about a specific component package	1-1
MaterialHandler	See 5.5.4.5	Information about a specific material handler (i.e. materialHandler, tray server).	1-1
Recipe	See 4.4.5	Identifies the recipe, program or algorithm	0-1

```
<ComponentNotRecognized
      informationType="LeadOutOfTolerance">
      <Nozzle
            nozzleType="912"
            headId="1"
            nozzleSegmentId="2"
      />
      <MaterialHandler
            materialSupplyArea="Front"
            trackId=3
            materialHandlerType="FEEDER"
            feederType="8mm Tape"
            feederDivision="2"
      />
      <Component
            componentId="SOIC-16"
            partId="AZ266533E5Z"
      />
</ComponentNotRecognized>
```

5.5.7.5 InformationId: MaterialHandlerTableInstalled

Definition: A materialHandler table is added to a component supply area.

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
materialHandlerTableId	string	Unique identification of a specific materialHandler table	1-1
messageInitiator	enumerated string	A description of how this message was initiated. OPERATOR | HOST | AUTOMATIC.	0-1
Component	See 5.5.4.1	Information about a specific component package	0-1

```
<MaterialHandlerTableInstalled
      materialHandlerTableId="Left"
      messageInitiator="OPERATOR"
/>
```

5.5.7.6 InformationId: MaterialHandlerTableUnInstalled

Definition: A materialHandler table is removed from a component supply area.

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
materialHandlerTableId	string	Unique identification of a specific materialHandler table	1-1
Component	See 5.5.4.1	Information about a specific component package	0-1
messageInitiator	enumerated string	A description of how this message was initiated. OPERATOR | HOST | AUTOMATIC.	0-1

```
<MaterialHandlerTableUnInstalled
      materialHandlerTableId="Left"
      messageInitiator="OPERATOR"
/>
```

5.5.7.7 InformationId: MaterialHandlerDivisionUp

Definition: The materialHandler is available.

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
MaterialHandler	See 5.5.4.5	Information about a specific material handler (i.e. materialHandler, tray server).	1-1
Component	See 5.5.4.1	Information about a specific component package	0-1
MessageInitiator	enumerated string	A description of how this message was initiated. OPERATOR | HOST | AUTOMATIC.	0-1

```
<MaterialHandlerDivisionUp
      messageInitiator="OPERATOR">
      <MaterialHandler
            materialSupplyArea="Front"
            trackId=3
            materialHandlerType="FEEDER"
            feederType="8mm Tape"
            feederDivision="2"
      />
      <Component
            componentId="SOIC-16"
            partId="AZ266533E5Z"
      />
</MaterialHandlerDivisionUp>
```

5.5.7.8 InformationId: MaterialHandlerRefilled

Definition: The materialHandler has been refilled with components.

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
MaterialHandler	See 5.5.4.5	Information about a specific material handler (i.e. materialHandler, tray server).	1-1
Component	See 5.5.4.1	Information about a specific component package	1-1
ComponentValidation	See 5.5.4.2	Information about a specific batch/lot of components	0-1
MessageInitiator	enumerated string	A description of how this message was initiated. OPERATOR | HOST | AUTOMATIC.	0-1

```
<MaterialHandlerRefilled
      messageInitiator="OPERATOR">
      <MaterialHandler
            materialSupplyArea="Front"
            trackId=3
            materialHandlerType="FEEDER"
            feederType="8mm Tape"
            feederDivision="2"
      />
      <Component
```

```
                        componentId="SOIC-16"
                        partId="AZ266533E5Z"
                />
                <ComponentValidation
                        componentId="SOIC-16"
                        partId="73829-2329g-ADSJ-9999"
                        package="SOIC 16"
                />
        </MaterialHandlerRefilled>
```

5.5.7.9 InformationId: ComponentReject

Definition: The machine is rejecting a component. This might be caused by the recognition system. The component will not be placed.

Attribute / Element Name	Attribute / Element Type	Description	Occurrence
Component	See 5.5.4.1	Information about a specific component package	1-1
RejectLocation	string	The location where a component is rejected	1-1

```
        <ComponentReject
                rejectLocation="Front-Left">
                <Component
                        componentId="SOIC-16"
                        partId="AZ266533E5Z"
                />
        </ComponentReject>
```

5.5.7.10 InformationId: ItemWorkComplete

Definition: This should be a collection of information associated with the completion of the work done to this board. Information for this could be: ComponentsPlacedOnBoard,

5.6 Plated Through Hole Placement

Under Consideration

5.7 Solder Reflowing

Under Consideration

5.8 Wave Soldering

Under Consideration

5.9 Final Assembly and Packaging

Under Consideration

6 The Specific PCB-Assembly Equipment XML-Message Format

This document section describes in detail the XML-equipment message format, using XML-Schemas (instead of XML-DTD). A schema is a model for describing the structure of information. In XML-context, a schema describes a model for a whole class of documents. The model describes the possible arrangement of tags and text in a valid XML-document (or message). A schema might also be viewed as an agreement on a common vocabulary for a particular application domain (like the Electronics Manufacturing) that involves exchanging documents or messages.

XML Schema documents are XML documents (unlike DTD documents). More about XML Schema can be found under www.w3c.com and www.xml.com.

The purpose of the following XML-Schema file describing the specific PCB-assembly equipment standard XML-message format, is to define a set of XML elements and attributes and the rules for their correct combination.

7 Equipment Flow Event Scenarios – Single Lane Equipment

7.1 Scenario 1, Version 1

Component Types SOIC

Scenario - Equipment Idle; single item enters system and is processed. Equipment has single lane, single working zone.
Note: LR is a label reader.
The equipment runs out of components and stops. The materialHandler is refilled and work resumes.

```
    LR
_______________________________________________________ Lane 1
          |          |          |            |
INPUT     |  INPUT   |  WORKING |  OUTPUT    |    OUTPUT
CONVEYOR  |  ZONE-1  |  ZONE-2  |  ZONE-3    |  CONVEYOR
          |          |          |            |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Steady state condition, no items anywhere. Equipment previously issued message associated with EquipmentStarved event.

====================================

Event: -

State: Ready-Idle-Starved

```
    LR
____001__________________________________________________ Lane 1
           |           |           |            |
INPUT      |  INPUT    |  WORKING  |  OUTPUT    |   OUTPUT
CONVEYOR   |  ZONE-1   |  ZONE-2   |  ZONE-3    |  CONVEYOR
           |           |           |            |
           |-------PIECE OF EQUIPMENT--------|
```

Action: Single item enters the system for processing. Item becomes available on the Input Conveyor, equipment no longer starved.

================================

Event:	ItemLabelRead
State:	Ready-Idle-Starved
dateTime:	2000-02-02T10:35:00.00-05:00
itemInstanceId:	001
laneRange:	1
zoneRange:	1
scannerId:	Scanner 1; top

=====================================

Event:	EquipmentUnStarved
State:	Ready-Processing-Active
DateTime:	2000-02-02T10:35:00.00-05:00

=====================================

Event:	EquipmentChangeState
State:	Ready-Processing-Active
dateTime:	2000-02-02T10:35:00.00-05:00
previousState:	Ready-Idle-Starved
currentState:	Ready-Processing-Active
eventId:	EquipmentUnStarved

```
LR
______________001______________________________________ Lane 1
          |          |          |          |
INPUT     |  INPUT   | WORKING  |  OUTPUT  |   OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3  |  CONVEYOR
          |          |          |          |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Input Zone completes.

================================

Event:	ItemTransferIn
State:	Ready-Processing-Active
dateTime:	2000-02-02T10:36:00.00-05:00
itemInstanceId:	001
laneRange:	1

```
    LR
_________________________001___________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   |  WORKING |  OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1  |  ZONE-2  |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Working Zone completes.

==================================

Event:	ItemTransferZone
State:	Ready-Processing-Active
dateTime:	2000-02-02T10:37:00.00-05:00
itemInstanceId:	001
fromZoneId:	1
toZoneId:	2
laneRange:	1

```
LR
_________________________001____________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   | WORKING  |  OUTPUT   |   OUTPUT
CONVEYOR  |  ZONE-1  | ZONE-2   |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

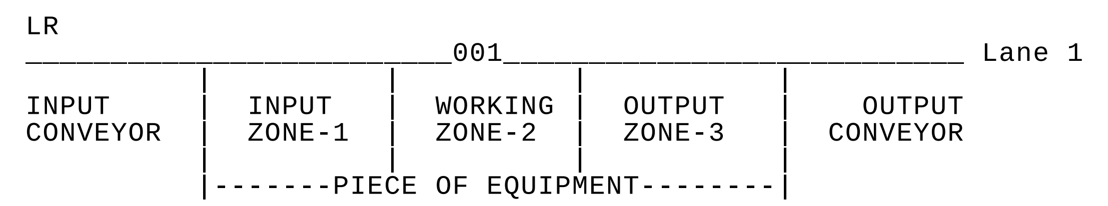
Action: Processing of item begins.

===============================

Event:	ItemWorkStart
State:	Ready-Processing-Executing
dateTime:	2000-02-02T10:37:00.00-05:00
itemInstanceId:	001
laneRange:	1
zoneRange:	2

======================================

Event:	EquipmentChangeState
State:	Ready-Processing-Executing
dateTime:	2000-02-02T10:37:00.00-05:00
previousState:	Ready-Processing-Active
currentState:	Ready-Processing-Executing
eventId:	ItemWorkStart



Action: Equipment is running out of components.

Event:	EquipmentInformation
State:	Ready-Processing-Executing
dateTime:	2000-02-02T10:40:00.00-05:00
InformationId:	ComponentMissPick
laneRange:	1
zoneRange:	2

2546 extension of a 2451 event:

	ComponentMissPick
informationType:	MissingOnNozzle
Nozzle:	
nozzleType	912
headId	1
nozzleSegmentId	2
MaterialHandler:	
materialSupplyArea	"Front"
trackId	4
materialHandlerType	FEEDER
feederType	"8mm Tape"
feederDivision	"2"
Component:	
componentId	"0402"
designator	"R100"
imageId	"2"
recognitionReference	"100.gf"
package	"0402"

==================================

Event:	EquipmentInformation
State:	Ready-Processing-Executing
dateTime:	2000-02-02T10:41:00.00-05:00
InformationId:	ComponentMissPick
laneRange:	1
zoneRange:	2

2546 extension of a 2451 event:

	ComponentMissPick
informationType:	MissingOnNozzle
Nozzle:	
nozzleType	912
headId	1
nozzleSegmentId	2
MaterialHandler:	
materialSupplyArea	"Front"
trackId	4
materialHandlerType	FEEDER
feederType	"8mm Tape"
feederDivision	"2"
Component:	
componentId	"0402"
designator	"R100"
imageId	"2"
recognitionReference	"100.gf"
package	"0402"

```
===================================
Event:                        EquipmentInformation
State:                        Ready-Processing-Executing
----------------------------------------------------------------------------
dateTime:                     2000-02-02T10:42:00.00-05:00
InformationId:                ComponentMissPick
laneRange:                    1
zoneRange:                    2
----------------------------------------------------------------------------

2546 extension of a 2451 event:
                              ComponentMissPick
----------------------------------------------------------------------------
informationType:              MissingOnNozzle
Nozzle:
     nozzleType               912
     headId                   1
     nozzleSegmentId               2
MaterialHandler:

     materialSupplyArea       "Front"
     trackId                  4
     materialHandlerType      FEEDER
     feederType               "8mm Tape"
     feederDivision           "2"
Component:
     componentId              "0402"
     designator               "R100"
     imageId                  "2"

     recognitionReference     "100.gf"
package                  "0402"
```

Event:	EquipmentWarning
State:	Ready-Processing-Executing
dateTime:	2000-02-02T10:42:00.00-05:00
warningId:	MaterialHandlerOutOfComponent
warningInstanceId:	W4
laneRange:	1
zoneRange:	2

2546 extension of a 2451 event:

	MaterialHandlerOutOfComponent
decrementMisPickCount:	3
MaterialHandler:	
materialSupplyArea	"Front"
trackId	4
materialHandlerType	FEEDER
feederType	"8mm Tape"
feederDivision	"2"
Component:	
componentId	"0402"

```
==================================
Event:                      ItemWorkPause
State:                      Ready-Processing-Executing
------------------------------------------------------------
dateTime:                   2000-02-02T10:42:00.00-05:00
itemInstanceId:             001
laneRange:                  1
zoneRange:                  2
pauseId:                    Machine down

======================================
Event:                      EquipmentChangeState
------------------------------------------------------------
DateTime:                   2000-02-02T10:42:00.00-10:00
PreviousState:              Ready-Processing-Executing
CurrentState:               Ready-Processing-Executing
EventId:                    ItemworkPause

==================================
Event:                      EquipmentError
State:                      Ready-Processing-Executing
------------------------------------------------------------
dateTime:                   2000-02-02T10:42:00.00-05:00
errorId:                    EquipmentOutOfComponent
errorInstanceId:            E1
laneRange:                  1
zoneRange:                  2

2546 extension of a 2541 event:
                            EquipmentOutOfComponent
------------------------------------------------------------
Component:
     componentId            "0402"


======================================
Event:                      EquipmentChangeState
------------------------------------------------------------
DateTime:                   2000-02-02T10:42:00.00-05:00
PreviousState:              Ready-Processing-Executing
CurrentState:               Down
EventId:                    EquipmentError
```

```
==================================
Event:                        EquipmentInformation
dateTime:                     2000-02-02T11:04:00.00-05:00
informationId:                MaterialHandlerRefilled
laneRange:                    1
zoneRange:                    2

2546 extension of a 2541 event:
                              MaterialHandlerRefilled
MaterialHandler:
           materialSupplyArea     "Front"
     trackId                  4
     materialHandlerType      FEEDER
     feederType               "8mm Tape"
     feederDivision           "2"
Component:
     componentId              "0402"

==================================
Event:                        EquipmentWarningCleared
dateTime:                     2000-02-02T11:04:00.00-05:00
warningInstanceId:            W4

==================================
Event:                        EquipmentErrorCleared
dateTime:                     2000-02-02T11:04:00.00-05:00
errorInstanceId:              E1

==================================
Event:                        EquipmentStartSelected
dateTime:                     2000-02-02T11:04:00.00-05:00
messageInitiator:                  OPERATOR

======================================
Event:                        EquipmentChangeState
dateTime:                     2000-02-02T11:04:00.00-05:00
previousState:                Down
currentState:                 Ready-Processing-Active
eventId:                      EquipmentStartSelected

==================================
Event:                        ItemWorkResume
dateTime:                     2000-02-02T11:07:00.00-10:00
itemInstanceId:               001
laneRange:                    1
zoneRange:                    2

======================================
Event:                        EquipmentChangeState
dateTime:                     2000-02-02T11:07:00.00-15:00
previousState:                Ready-Processing-Active
currentState:                 Ready-Processing-Executing
eventId:                      ItemWorkResume
```

```
    LR
________________________001___________________________ Lane 1
          |          |          |           |
INPUT     |  INPUT   |  WORKING |  OUTPUT   |    OUTPUT
CONVEYOR  |  ZONE-1  |  ZONE-2  |  ZONE-3   |  CONVEYOR
          |          |          |           |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Processing of item completes.

==================================

Event:	ItemWorkComplete
State:	Ready-Processing-Active
dateTime:	2000-02-02T11:07:00.00-05:00
itemInstanceId:	001
laneRange:	1
zoneRange:	2

======================================

Event:	EquipmentChangeState
State:	Ready-Processing-Active
dateTime:	2000-02-02T11:07:00.00-05:00
previousState:	Ready-Processing-Executing
currentState:	Ready-Processing-Active
eventId:	ItemWorkComplete

```
LR
____________________________________001_________________ Lane 1
          |          |          |          |
INPUT     |  INPUT   |  WORKING |  OUTPUT  |    OUTPUT
CONVEYOR  |  ZONE-1  |  ZONE-2  |  ZONE-3  |  CONVEYOR
          |          |          |          |
          |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Output Zone completes.

==================================

Event:	ItemTransferZone
State:	Ready-Processing-Active
dateTime:	2000-02-02T11:07:00.00-05:00
itemInstanceId:	001
fromZoneId:	2
toZoneId:	3
laneRange:	1

```
    LR
_______________________________________________________001___ Lane 1
            |            |            |             |
INPUT       |  INPUT     |  WORKING   |  OUTPUT     |    OUTPUT
CONVEYOR    |  ZONE-1    |  ZONE-2    |  ZONE-3     |  CONVEYOR
            |            |            |             |
            |-------PIECE OF EQUIPMENT--------|
```

Action: Transfer of item to Output Conveyor completes. Equipment becomes starved as no items are available.

====================================

Event:	ItemTransferOut
State:	Ready-Processing-Active
dateTime:	2000-02-02T11:07:00.00-05:00
itemInstanceId:	001
laneRange:	1

====================================

Event:	EquipmentStarved
State:	Ready-Idle-Starved
dateTime:	2000-02-02T11:07:00.00-05:00

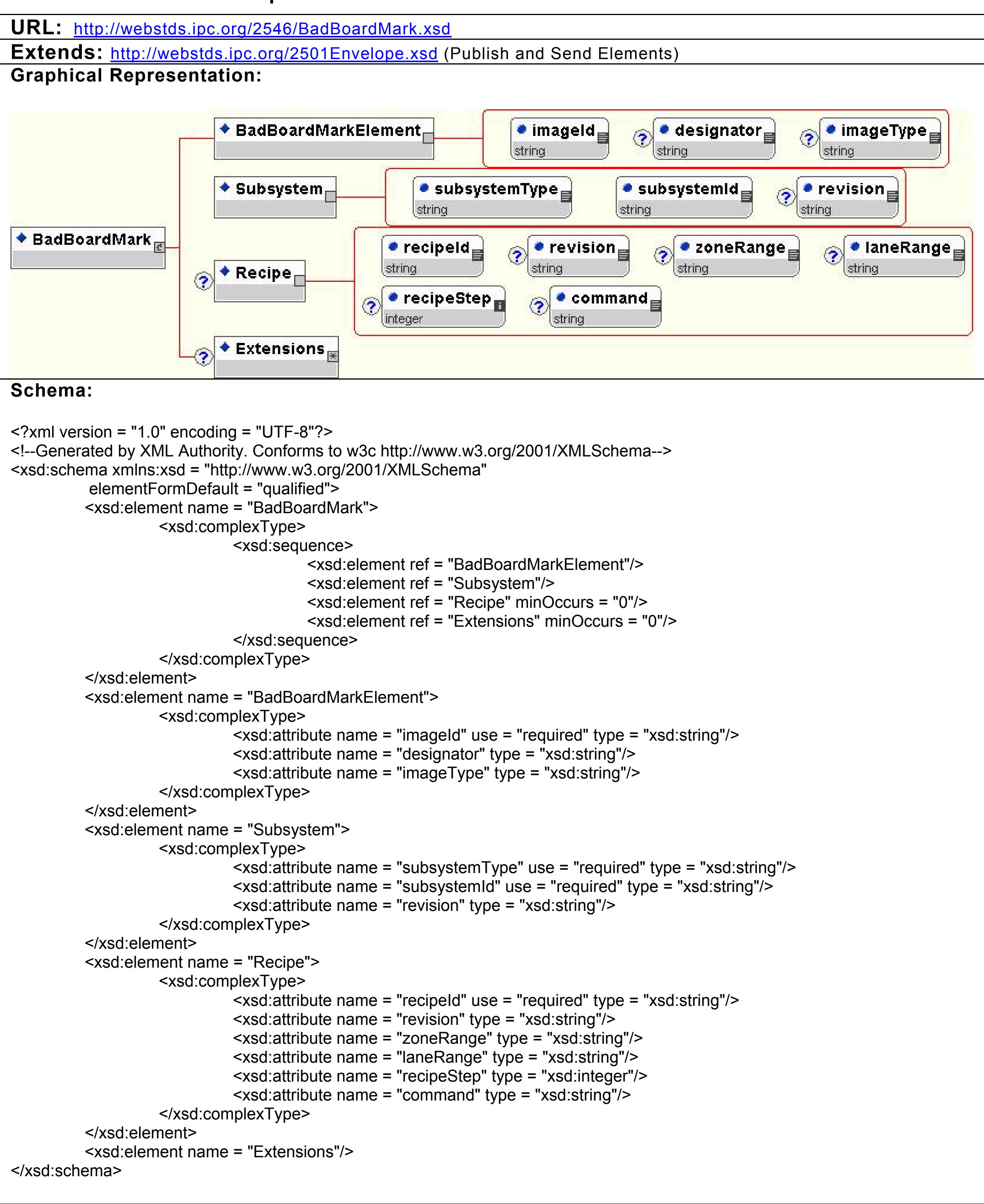
====================================

Event:	EquipmentChangeState
State:	Ready-Idle-Starved
dateTime:	2000-02-02T11:07:00.00-05:00
previousState:	Ready-Processing-Active
currentState:	Ready-Idle-Starved
eventId:	EquipmentStarved

8 2546 XML Schema

Here is the complete listing of the XML schema for IPC-2546. The Uniform Resource Indicator (URL) for each IPC-2546 schema is listed first, followed by the XML schema for the IPC-2500 that it extends. A graphical representation of each IPC-2546 schema is then shown, followed by the actual schema definition for each of the 2546 events.

8.1 BadBoardMarkReport



URL: http://webstds.ipc.org/2546/BadBoardMark.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

Schema:

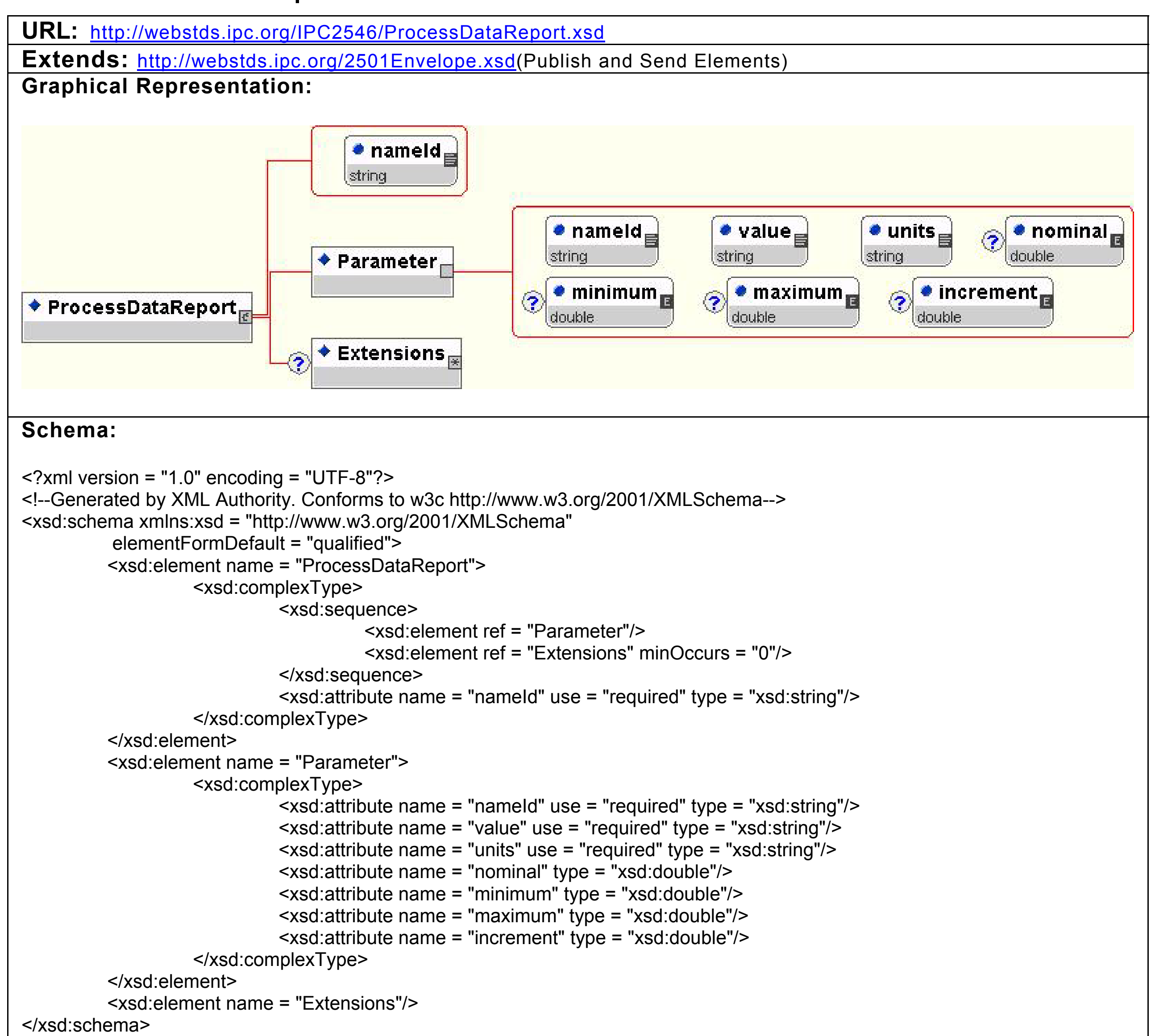
```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
         elementFormDefault = "qualified">
        <xsd:element name = "BadBoardMark">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "BadBoardMarkElement"/>
                                <xsd:element ref = "Subsystem"/>
                                <xsd:element ref = "Recipe" minOccurs = "0"/>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "BadBoardMarkElement">
                <xsd:complexType>
                        <xsd:attribute name = "imageId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "designator" type = "xsd:string"/>
                        <xsd:attribute name = "imageType" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Subsystem">
                <xsd:complexType>
                        <xsd:attribute name = "subsystemType" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "subsystemId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "revision" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Recipe">
                <xsd:complexType>
                        <xsd:attribute name = "recipeId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "revision" type = "xsd:string"/>
                        <xsd:attribute name = "zoneRange" type = "xsd:string"/>
                        <xsd:attribute name = "laneRange" type = "xsd:string"/>
                        <xsd:attribute name = "recipeStep" type = "xsd:integer"/>
                        <xsd:attribute name = "command" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.2 ProcessDataReport

URL: http://webstds.ipc.org/IPC2546/ProcessDataReport.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd(Publish and Send Elements)

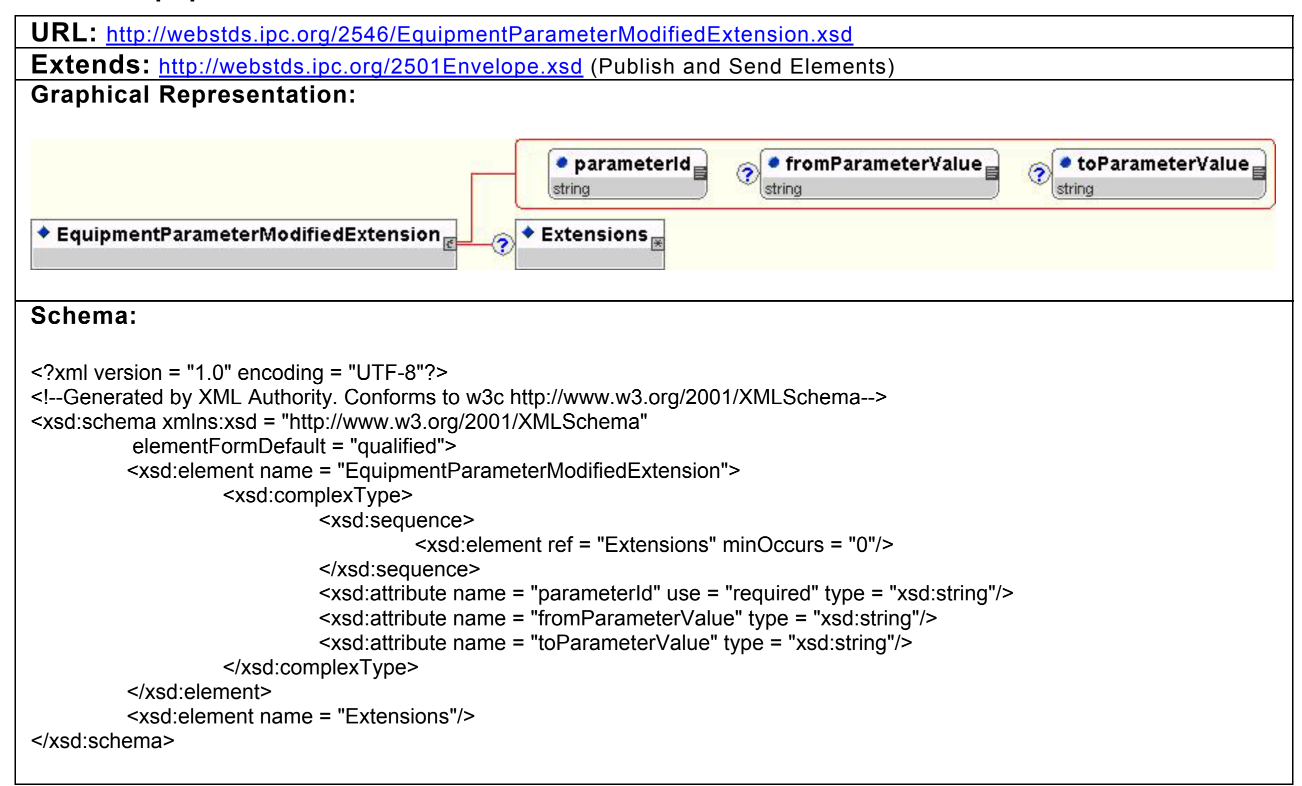
Graphical Representation:



Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
         elementFormDefault = "qualified">
        <xsd:element name = "ProcessDataReport">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Parameter"/>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "nameId" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Parameter">
                <xsd:complexType>
                        <xsd:attribute name = "nameId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "value" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "units" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "nominal" type = "xsd:double"/>
                        <xsd:attribute name = "minimum" type = "xsd:double"/>
                        <xsd:attribute name = "maximum" type = "xsd:double"/>
                        <xsd:attribute name = "increment" type = "xsd:double"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.3 EquipmentParameterModifiedExtension



URL: http://webstds.ipc.org/2546/EquipmentParameterModifiedExtension.xsd

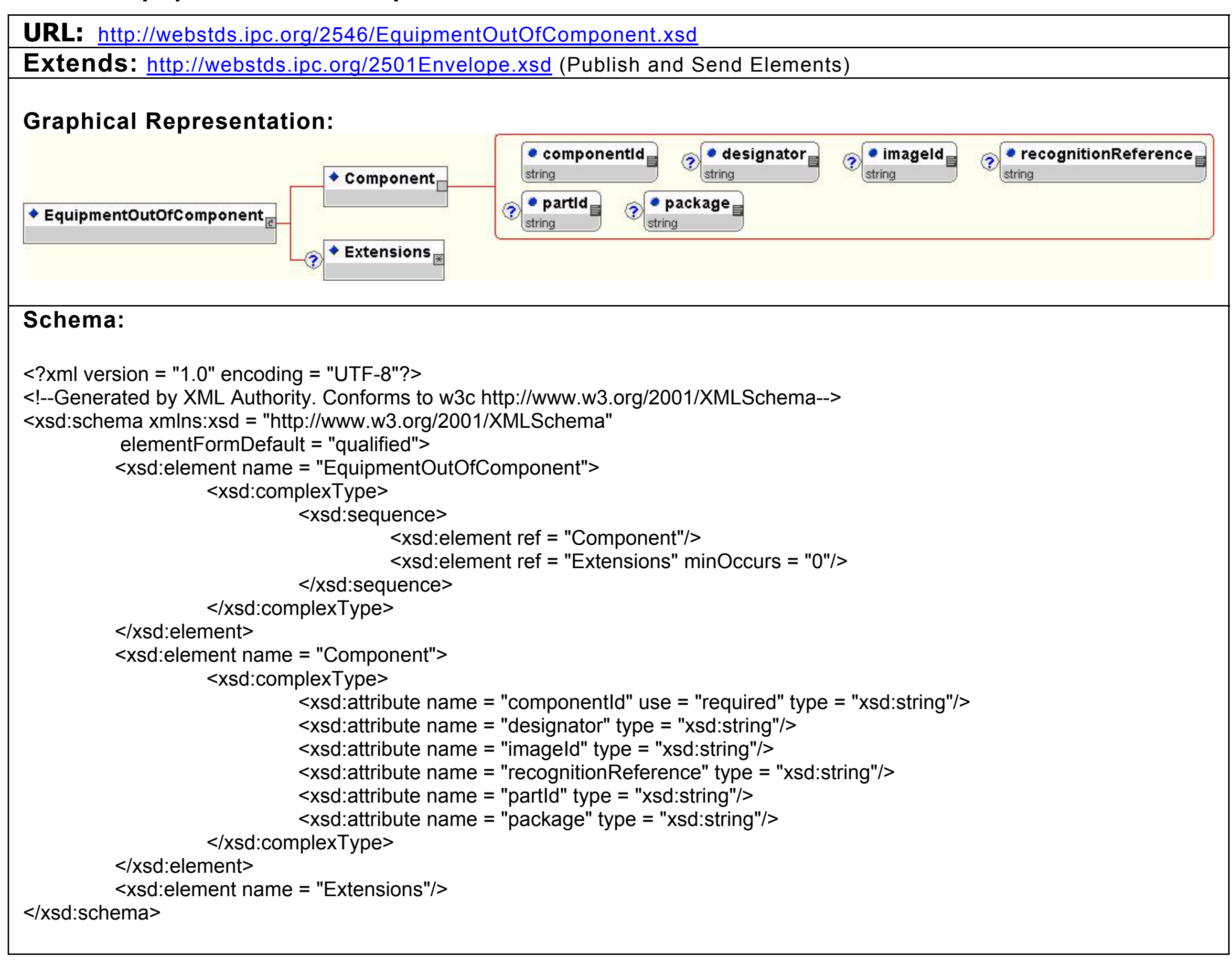
Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
         elementFormDefault = "qualified">
        <xsd:element name = "EquipmentParameterModifiedExtension">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "parameterId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "fromParameterValue" type = "xsd:string"/>
                        <xsd:attribute name = "toParameterValue" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.4 EquipmentOutOfComponent



URL: http://webstds.ipc.org/2546/EquipmentOutOfComponent.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

Schema:

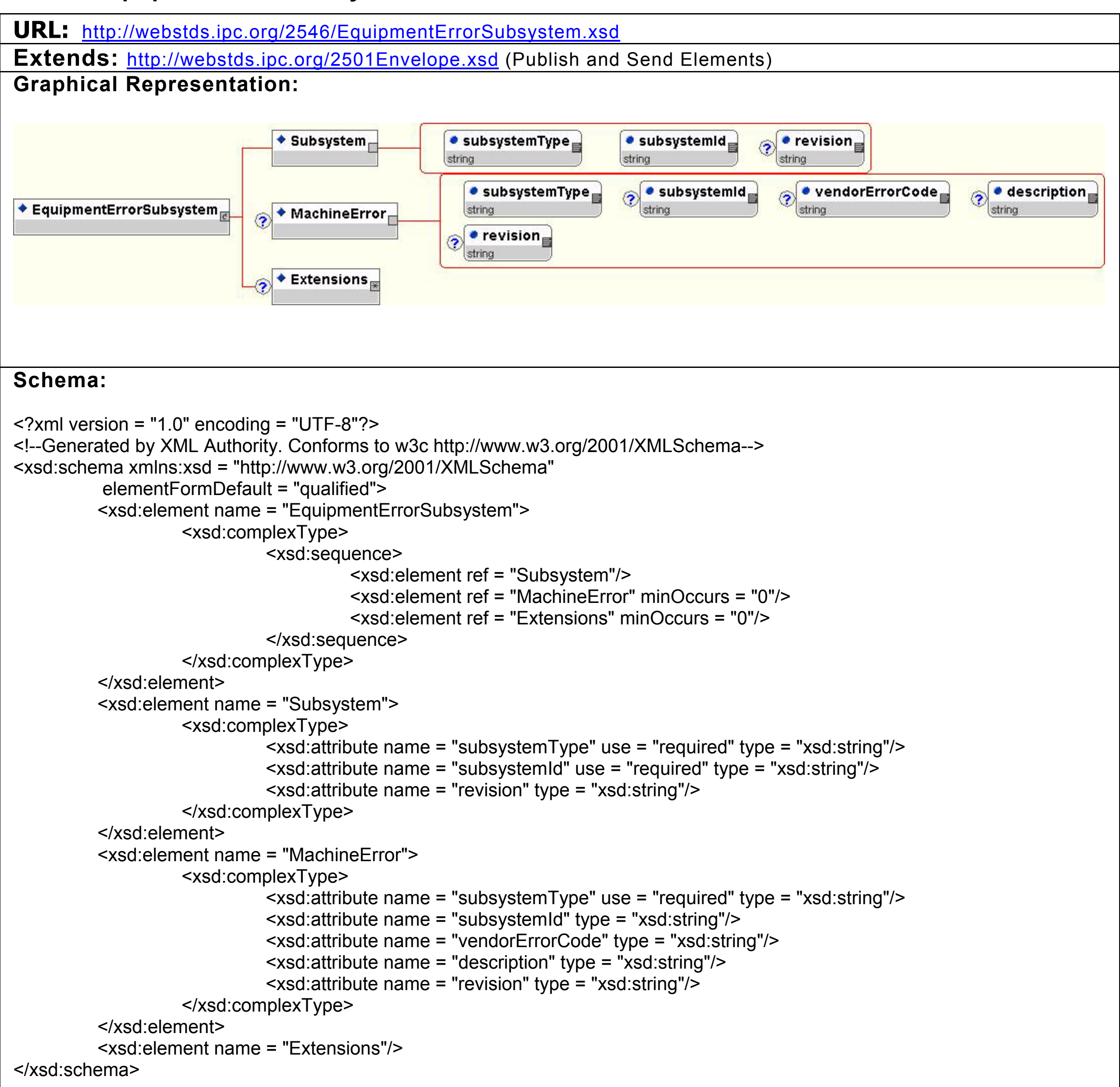
```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
     elementFormDefault = "qualified">
     <xsd:element name = "EquipmentOutOfComponent">
          <xsd:complexType>
               <xsd:sequence>
                    <xsd:element ref = "Component"/>
                    <xsd:element ref = "Extensions" minOccurs = "0"/>
               </xsd:sequence>
          </xsd:complexType>
     </xsd:element>
     <xsd:element name = "Component">
          <xsd:complexType>
               <xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
               <xsd:attribute name = "designator" type = "xsd:string"/>
               <xsd:attribute name = "imageId" type = "xsd:string"/>
               <xsd:attribute name = "recognitionReference" type = "xsd:string"/>
               <xsd:attribute name = "partId" type = "xsd:string"/>
               <xsd:attribute name = "package" type = "xsd:string"/>
          </xsd:complexType>
     </xsd:element>
     <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.5 EquipmentErrorSubsystem

URL: http://webstds.ipc.org/2546/EquipmentErrorSubsystem.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:



Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
         elementFormDefault = "qualified">
        <xsd:element name = "EquipmentErrorSubsystem">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Subsystem"/>
                                <xsd:element ref = "MachineError" minOccurs = "0"/>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Subsystem">
                <xsd:complexType>
                        <xsd:attribute name = "subsystemType" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "subsystemId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "revision" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "MachineError">
                <xsd:complexType>
                        <xsd:attribute name = "subsystemType" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "subsystemId" type = "xsd:string"/>
                        <xsd:attribute name = "vendorErrorCode" type = "xsd:string"/>
                        <xsd:attribute name = "description" type = "xsd:string"/>
                        <xsd:attribute name = "revision" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.6 ItemRecognitionFailure

URL: http://webstds.ipc.org/2546/ItemRecognitionFailure.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

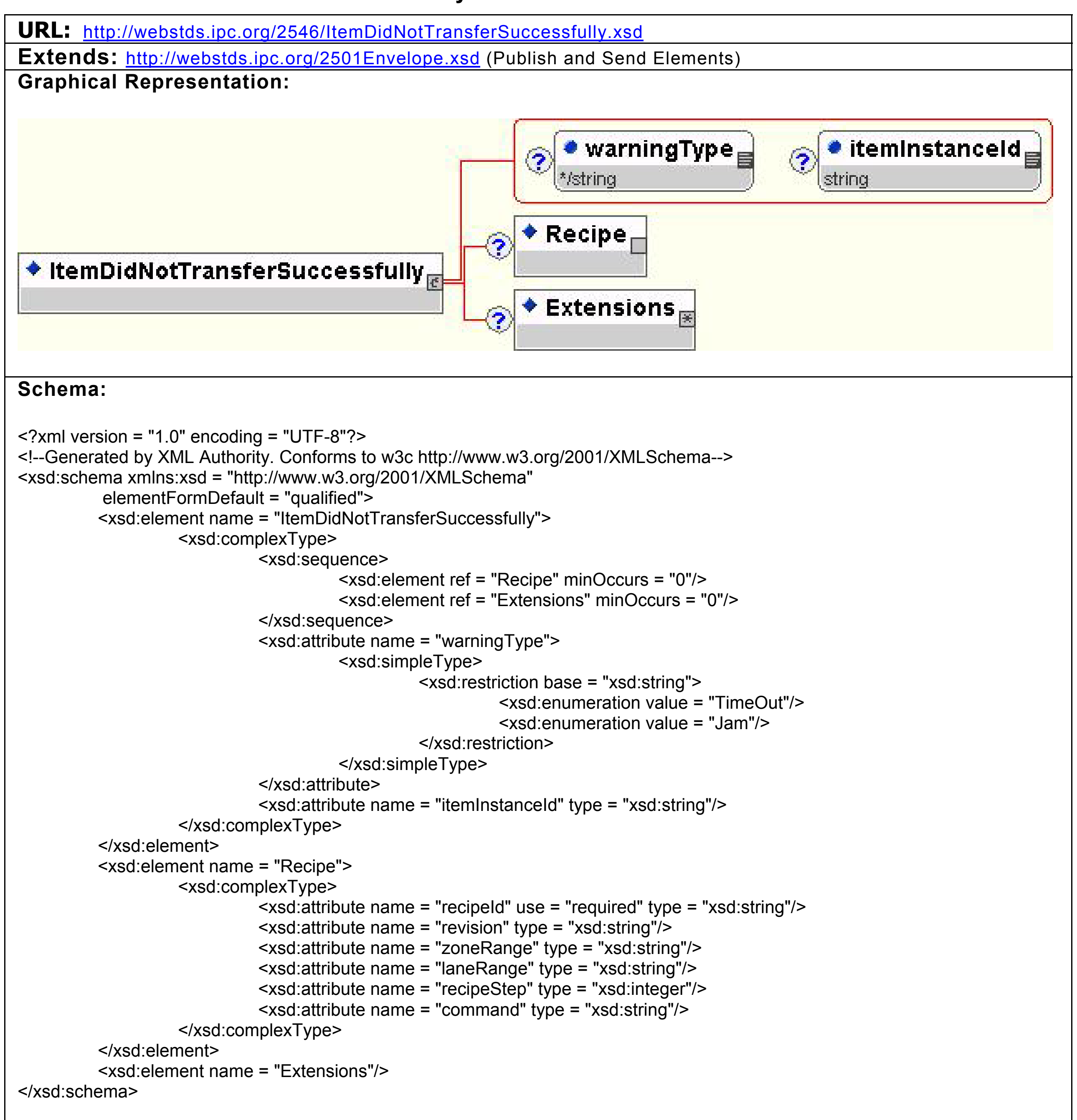
ItemRecognitionFailure
warningType */string
itemInstanceId string
Fiducial
designator string
imageId string
imageType string
imageShape string
recognitionReference string
score positiveInteger
Subsystem
subsystemType string
subsystemId string
revision string
Recipe
recipeId string
revision string
zoneRange string
laneRange string
recipeStep integer
command string
Extensions

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
         elementFormDefault = "qualified">
    <xsd:element name = "ItemRecognitionFailure">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element ref = "Fiducial"/>
                <xsd:element ref = "Subsystem" minOccurs = "0"/>
                <xsd:element ref = "Recipe" minOccurs = "0"/>
                <xsd:element ref = "Extensions" minOccurs = "0"/>
            </xsd:sequence>
            <xsd:attribute name = "warningType" use = "required">
                <xsd:simpleType>
                    <xsd:restriction base = "xsd:string">
                        <xsd:enumeration value = "MissingFiducial"/>
                        <xsd:enumeration value = "BadMeasurement"/>
                    </xsd:restriction>
                </xsd:simpleType>
            </xsd:attribute>
            <xsd:attribute name = "itemInstanceId" use = "required" type = "xsd:string"/>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "Subsystem">
        <xsd:complexType>
            <xsd:attribute name = "subsystemType" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "subsystemId" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "revision" type = "xsd:string"/>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "Fiducial">
        <xsd:complexType>
            <xsd:attribute name = "designator" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "imageId" type = "xsd:string"/>
            <xsd:attribute name = "imageType" type = "xsd:string"/>
            <xsd:attribute name = "imageShape" type = "xsd:string"/>
            <xsd:attribute name = "recognitionReference" type = "xsd:string"/>
            <xsd:attribute name = "score" type = "xsd:positiveInteger"/>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "Recipe">
```

```
                <xsd:complexType>
                        <xsd:attribute name = "recipeId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "revision" type = "xsd:string"/>
                        <xsd:attribute name = "zoneRange" type = "xsd:string"/>
                        <xsd:attribute name = "laneRange" type = "xsd:string"/>
                        <xsd:attribute name = "recipeStep" type = "xsd:integer"/>
                        <xsd:attribute name = "command" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.7 ItemDidNotTransferSuccessfully



URL: http://webstds.ipc.org/2546/ItemDidNotTransferSuccessfully.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
         elementFormDefault = "qualified">
        <xsd:element name = "ItemDidNotTransferSuccessfully">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Recipe" minOccurs = "0"/>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "warningType">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "TimeOut"/>
                                                <xsd:enumeration value = "Jam"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                        <xsd:attribute name = "itemInstanceId" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Recipe">
                <xsd:complexType>
                        <xsd:attribute name = "recipeId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "revision" type = "xsd:string"/>
                        <xsd:attribute name = "zoneRange" type = "xsd:string"/>
                        <xsd:attribute name = "laneRange" type = "xsd:string"/>
                        <xsd:attribute name = "recipeStep" type = "xsd:integer"/>
                        <xsd:attribute name = "command" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.8 MaterialHandlerLow

URL: http://webstds.ipc.org/2546/MaterialHandlerLow.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
        elementFormDefault = "qualified">
    <xsd:element name = "MaterialHandlerLow">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element ref = "MaterialHandler"/>
                <xsd:element ref = "Component" minOccurs = "0"/>
                <xsd:element ref = "Extensions" minOccurs = "0"/>
            </xsd:sequence>
            <xsd:attribute name = "warningType" use = "required">
                <xsd:simpleType>
                    <xsd:restriction base = "xsd:string">
                        <xsd:enumeration value = "MeasuredMaterialHandlerLow"/>
                        <xsd:enumeration value = "EstimatedMaterialHandlerLow"/>
                    </xsd:restriction>
                </xsd:simpleType>
            </xsd:attribute>
            <xsd:attribute name = "estimatedTimeTillEndOfComponents" type = "xsd:integer"/>
            <xsd:attribute name = "numberOfComponentsLeft" type = "xsd:string"/>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "MaterialHandler">
        <xsd:complexType>
            <xsd:attribute name = "materialSupplyArea" type = "xsd:string"/>
            <xsd:attribute name = "trackId" use = "required" type = "xsd:integer"/>
            <xsd:attribute name = "partId" type = "xsd:string"/>
            <xsd:attribute name = "materialHandlerType" use = "required">
                <xsd:simpleType>
                    <xsd:restriction base = "xsd:string">
                        <xsd:enumeration value = "FEEDER"/>
                        <xsd:enumeration value = "TRAYSERVER"/>
                    </xsd:restriction>
                </xsd:simpleType>
            </xsd:attribute>
            <xsd:attribute name = "materialHandlerTableId" type = "xsd:string"/>
            <xsd:attribute name = "feederType" type = "xsd:string"/>
            <xsd:attribute name = "feederDivision" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "trayServerType" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "trayServerTower" type = "xsd:integer"/>
            <xsd:attribute name = "trayServerLocation" use = "required" type = "xsd:integer"/>
            <xsd:attribute name = "traySection" type = "xsd:string"/>
            <xsd:attribute name = "trayDivision" type = "xsd:string"/>
```

```
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Component">
                <xsd:complexType>
                        <xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "designator" type = "xsd:string"/>
                        <xsd:attribute name = "imageId" type = "xsd:string"/>
                        <xsd:attribute name = "recognitionReference" type = "xsd:string"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "package" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.9 MaterialHandlerInstalled

URL: http://webstds.ipc.org/2546/MaterialHandlerInstalled.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
     elementFormDefault = "qualified">
    <xsd:element name = "MaterialHandlerInstalled">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element ref = "MaterialHandler"/>
                <xsd:element ref = "Component" minOccurs = "0"/>
                <xsd:element ref = "Extensions" minOccurs = "0"/>
            </xsd:sequence>
            <xsd:attribute name = "messageInitiator">
                <xsd:simpleType>
                    <xsd:restriction base = "xsd:string">
                        <xsd:enumeration value = "OPERATOR"/>
                        <xsd:enumeration value = "HOST"/>
                        <xsd:enumeration value = "AUTOMATIC"/>
                    </xsd:restriction>
                </xsd:simpleType>
            </xsd:attribute>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "MaterialHandler">
        <xsd:complexType>
            <xsd:attribute name = "materialSupplyArea" type = "xsd:string"/>
            <xsd:attribute name = "trackId" use = "required" type = "xsd:integer"/>
            <xsd:attribute name = "partId" type = "xsd:string"/>
            <xsd:attribute name = "materialHandlerType" use = "required">
                <xsd:simpleType>
                    <xsd:restriction base = "xsd:string">
                        <xsd:enumeration value = "FEEDER"/>
                        <xsd:enumeration value = "TRAYSERVER"/>
                    </xsd:restriction>
                </xsd:simpleType>
            </xsd:attribute>
            <xsd:attribute name = "materialHandlerTableId" type = "xsd:string"/>
            <xsd:attribute name = "feederType" type = "xsd:string"/>
            <xsd:attribute name = "feederDivision" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "trayServerType" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "trayServerTower" type = "xsd:integer"/>
            <xsd:attribute name = "trayServerLocation" use = "required" type = "xsd:integer"/>
            <xsd:attribute name = "traySection" type = "xsd:string"/>
            <xsd:attribute name = "trayDivision" type = "xsd:string"/>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "Component">
```

```
                <xsd:complexType>
                        <xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "designator" type = "xsd:string"/>
                        <xsd:attribute name = "imageId" type = "xsd:string"/>
                        <xsd:attribute name = "recognitionReference" type = "xsd:string"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "package" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.10 MaterialHandlerUnInstalled

URL: http://webstds.ipc.org/2546/MaterialHandlerUnInstalled.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

MaterialHandlerUnInstalled
messageInitiator */string
MaterialHandler
materialSupplyArea string
trackId integer
partId string
materialHandlerType */string
materialHandlerTableId string
feederType string
feederDivision string
trayServerType string
trayServerTower integer
trayServerLocation integer
traySection string
trayDivision string
Component
componentId string
designator string
imageId string
recognitionReference string
partId string
package string
Extensions

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
         elementFormDefault = "qualified">
        <xsd:element name = "MaterialHandlerUnInstalled">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "MaterialHandler"/>
                                <xsd:element ref = "Component" minOccurs = "0"/>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "messageInitiator">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "OPERATOR"/>
                                                <xsd:enumeration value = "HOST"/>
                                                <xsd:enumeration value = "AUTOMATIC"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "MaterialHandler">
                <xsd:complexType>
                        <xsd:attribute name = "materialSupplyArea" type = "xsd:string"/>
                        <xsd:attribute name = "trackId" use = "required" type = "xsd:integer"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "materialHandlerType" use = "required">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "FEEDER"/>
                                                <xsd:enumeration value = "TRAYSERVER"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                        <xsd:attribute name = "materialHandlerTableId" type = "xsd:string"/>
                        <xsd:attribute name = "feederType" type = "xsd:string"/>
                        <xsd:attribute name = "feederDivision" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerType" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerTower" type = "xsd:integer"/>
                        <xsd:attribute name = "trayServerLocation" use = "required" type = "xsd:integer"/>
                        <xsd:attribute name = "traySection" type = "xsd:string"/>
                        <xsd:attribute name = "trayDivision" type = "xsd:string"/>
                </xsd:complexType>
```

```
        </xsd:element>
        <xsd:element name = "Component">
                <xsd:complexType>
                        <xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "designator" type = "xsd:string"/>
                        <xsd:attribute name = "imageId" type = "xsd:string"/>
                        <xsd:attribute name = "recognitionReference" type = "xsd:string"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "package" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.11 MaterialHandlerDivisionDown

URL: http://webstds.ipc.org/2546/MaterialHandlerDivisionDown.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

MaterialHandlerDivisionDown
messageInitiator */string
MaterialHandler
materialSupplyArea string
trackId integer
partId string
materialHandlerType */string
materialHandlerTableId string
feederType string
feederDivision string
trayServerType string
trayServerTower integer
trayServerLocation integer
traySection string
trayDivision string
Component
componentId string
designator string
imageId string
recognitionReference string
partId string
package string
Extensions

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
         elementFormDefault = "qualified">
        <xsd:element name = "MaterialHandlerDivisionDown">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "MaterialHandler"/>
                                <xsd:element ref = "Component" minOccurs = "0"/>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "messageInitiator">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "OPERATOR"/>
                                                <xsd:enumeration value = "HOST"/>
                                                <xsd:enumeration value = "AUTOMATIC"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "MaterialHandler">
                <xsd:complexType>
                        <xsd:attribute name = "materialSupplyArea" type = "xsd:string"/>
                        <xsd:attribute name = "trackId" use = "required" type = "xsd:integer"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "materialHandlerType" use = "required">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "FEEDER"/>
                                                <xsd:enumeration value = "TRAYSERVER"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                        <xsd:attribute name = "materialHandlerTableId" type = "xsd:string"/>
                        <xsd:attribute name = "feederType" type = "xsd:string"/>
                        <xsd:attribute name = "feederDivision" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerType" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerTower" type = "xsd:integer"/>
                        <xsd:attribute name = "trayServerLocation" use = "required" type = "xsd:integer"/>
                        <xsd:attribute name = "traySection" type = "xsd:string"/>
                        <xsd:attribute name = "trayDivision" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
```

```
		<xsd:element name = "Component">
			<xsd:complexType>
				<xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
				<xsd:attribute name = "designator" type = "xsd:string"/>
				<xsd:attribute name = "imageId" type = "xsd:string"/>
				<xsd:attribute name = "recognitionReference" type = "xsd:string"/>
				<xsd:attribute name = "partId" type = "xsd:string"/>
				<xsd:attribute name = "package" type = "xsd:string"/>
			</xsd:complexType>
		</xsd:element>
		<xsd:element name = "Extensions"/>
</xsd:schema>
```

8.12 MaterialHandlerTrouble

URL: http://webstds.ipc.org/2546/MaterialHandlerTrouble.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

MaterialHandlerTrouble
messageInitiator */string
MaterialHandler
materialSupplyArea string
trackId integer
partId string
materialHandlerType */string
materialHandlerTableId string
feederType string
feederDivision string
trayServerType string
trayServerTower integer
trayServerLocation integer
traySection string
trayDivision string
Component
componentId string
designator string
imageId string
recognitionReference string
partId string
package string
Extensions

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
         elementFormDefault = "qualified">
        <xsd:element name = "MaterialHandlerTrouble">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "MaterialHandler"/>
                                <xsd:element ref = "Component" minOccurs = "0"/>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "messageInitiator">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "OPERATOR"/>
                                                <xsd:enumeration value = "HOST"/>
                                                <xsd:enumeration value = "AUTOMATIC"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "MaterialHandler">
                <xsd:complexType>
                        <xsd:attribute name = "materialSupplyArea" type = "xsd:string"/>
                        <xsd:attribute name = "trackId" use = "required" type = "xsd:integer"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "materialHandlerType" use = "required">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "FEEDER"/>
                                                <xsd:enumeration value = "TRAYSERVER"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                        <xsd:attribute name = "materialHandlerTableId" type = "xsd:string"/>
                        <xsd:attribute name = "feederType" type = "xsd:string"/>
                        <xsd:attribute name = "feederDivision" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerType" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerTower" type = "xsd:integer"/>
                        <xsd:attribute name = "trayServerLocation" use = "required" type = "xsd:integer"/>
                        <xsd:attribute name = "traySection" type = "xsd:string"/>
                        <xsd:attribute name = "trayDivision" type = "xsd:string"/>
                </xsd:complexType>
```

```
        </xsd:element>
        <xsd:element name = "Component">
                <xsd:complexType>
                        <xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "designator" type = "xsd:string"/>
                        <xsd:attribute name = "imageId" type = "xsd:string"/>
                        <xsd:attribute name = "recognitionReference" type = "xsd:string"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "package" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.13 MaterialHandlerOutOfComponent

URL: http://webstds.ipc.org/2546/MaterialHandlerOutOfComponent.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
         elementFormDefault = "qualified">
        <xsd:element name = "MaterialHandlerOutOfComponent">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "MaterialHandler"/>
                                <xsd:element ref = "Component"/>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "DecrementMispickCount" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "MaterialHandler">
                <xsd:complexType>
                        <xsd:attribute name = "materialSupplyArea" type = "xsd:string"/>
                        <xsd:attribute name = "trackId" use = "required" type = "xsd:integer"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "materialHandlerType" use = "required">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "FEEDER"/>
                                                <xsd:enumeration value = "TRAYSERVER"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                        <xsd:attribute name = "materialHandlerTableId" type = "xsd:string"/>
                        <xsd:attribute name = "feederType" type = "xsd:string"/>
                        <xsd:attribute name = "feederDivision" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerType" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerTower" type = "xsd:integer"/>
                        <xsd:attribute name = "trayServerLocation" use = "required" type = "xsd:integer"/>
                        <xsd:attribute name = "traySection" type = "xsd:string"/>
                        <xsd:attribute name = "trayDivision" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Component">
                <xsd:complexType>
                        <xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "designator" type = "xsd:string"/>
                        <xsd:attribute name = "imageId" type = "xsd:string"/>
                        <xsd:attribute name = "recognitionReference" type = "xsd:string"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "package" type = "xsd:string"/>
```

```
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.14 ComponentMisPick

URL: http://webstds.ipc.org/2546/ComponentMisPick.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

ComponentMissPick
informationType */string
Recipe
recipeId string
revision string
zoneRange string
laneRange string
recipeStep integer
command string
Nozzle
partId string
nozzleType string
headId string
nozzleSegmentId string
MaterialHandler
materialSupplyArea string
trackId string
partId string
materialHandlerType string
materialHandlerTableId string
feederType string
feederDivision string
trayServerType string
trayServerTower string
trayServerLocation string
traySection string
trayDivision string
Component
componentId string
designator string
imageId string
recognitionReference string
partId string
package string
Extensions

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
     elementFormDefault = "qualified">
     <xsd:element name = "ComponentMissPick">
          <xsd:complexType>
               <xsd:sequence>
                    <xsd:element ref = "Recipe" minOccurs = "0"/>
                    <xsd:element ref = "Nozzle"/>
                    <xsd:element ref = "MaterialHandler"/>
                    <xsd:element ref = "Component"/>
                    <xsd:element ref = "Extensions" minOccurs = "0"/>
               </xsd:sequence>
               <xsd:attribute name = "informationType" use = "required">
                    <xsd:simpleType>
                         <xsd:restriction base = "xsd:string">
                              <xsd:enumeration value = "MissingOnNozzle"/>
                              <xsd:enumeration value = "MissAlignedComponent"/>
                         </xsd:restriction>
                    </xsd:simpleType>
               </xsd:attribute>
          </xsd:complexType>
     </xsd:element>
     <xsd:element name = "MaterialHandler">
          <xsd:complexType>
               <xsd:attribute name = "materialSupplyArea" type = "xsd:string"/>
               <xsd:attribute name = "trackId" use = "required" type = "xsd:string"/>
               <xsd:attribute name = "partId" type = "xsd:string"/>
               <xsd:attribute name = "materialHandlerType" type = "xsd:string"/>
               <xsd:attribute name = "materialHandlerTableId" type = "xsd:string"/>
               <xsd:attribute name = "feederType" type = "xsd:string"/>
               <xsd:attribute name = "feederDivision" use = "required" type = "xsd:string"/>
               <xsd:attribute name = "trayServerType" use = "required" type = "xsd:string"/>
               <xsd:attribute name = "trayServerTower" type = "xsd:string"/>
               <xsd:attribute name = "trayServerLocation" use = "required" type = "xsd:string"/>
               <xsd:attribute name = "traySection" type = "xsd:string"/>
               <xsd:attribute name = "trayDivision" type = "xsd:string"/>
```

```
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Component">
                <xsd:complexType>
                        <xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "designator" type = "xsd:string"/>
                        <xsd:attribute name = "imageId" type = "xsd:string"/>
                        <xsd:attribute name = "recognitionReference" type = "xsd:string"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "package" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Recipe">
                <xsd:complexType>
                        <xsd:attribute name = "recipeId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "revision" type = "xsd:string"/>
                        <xsd:attribute name = "zoneRange" type = "xsd:string"/>
                        <xsd:attribute name = "laneRange" type = "xsd:string"/>
                        <xsd:attribute name = "recipeStep" type = "xsd:integer"/>
                        <xsd:attribute name = "command" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Nozzle">
                <xsd:complexType>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "nozzleType" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "headId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "nozzleSegmentId" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.15 ComponentNotPlaced

URL: http://webstds.ipc.org/2546/ComponentNotPlaced.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
     elementFormDefault = "qualified">
    <xsd:element name = "ComponentNotPlaced">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element ref = "Recipe" minOccurs = "0"/>
                <xsd:element ref = "Nozzle"/>
                <xsd:element ref = "MaterialHandler"/>
                <xsd:element ref = "Component"/>
                <xsd:element ref = "Extensions" minOccurs = "0"/>
            </xsd:sequence>
            <xsd:attribute name = "informationType" use = "required">
                <xsd:simpleType>
                    <xsd:restriction base = "xsd:string">
                        <xsd:enumeration value = "LostDuringMovement"/>
                    </xsd:restriction>
                </xsd:simpleType>
            </xsd:attribute>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "MaterialHandler">
        <xsd:complexType>
            <xsd:attribute name = "materialSupplyArea" type = "xsd:string"/>
            <xsd:attribute name = "trackId" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "partId" type = "xsd:string"/>
            <xsd:attribute name = "materialHandlerType" type = "xsd:string"/>
            <xsd:attribute name = "materialHandlerTableId" type = "xsd:string"/>
            <xsd:attribute name = "feederType" type = "xsd:string"/>
            <xsd:attribute name = "feederDivision" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "trayServerType" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "trayServerTower" type = "xsd:string"/>
            <xsd:attribute name = "trayServerLocation" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "traySection" type = "xsd:string"/>
            <xsd:attribute name = "trayDivision" type = "xsd:string"/>
        </xsd:complexType>
```

```
        </xsd:element>
        <xsd:element name = "Component">
                <xsd:complexType>
                        <xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "designator" type = "xsd:string"/>
                        <xsd:attribute name = "imageId" type = "xsd:string"/>
                        <xsd:attribute name = "recognitionReference" type = "xsd:string"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "package" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Recipe">
                <xsd:complexType>
                        <xsd:attribute name = "recipeId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "revision" type = "xsd:string"/>
                        <xsd:attribute name = "zoneRange" type = "xsd:string"/>
                        <xsd:attribute name = "laneRange" type = "xsd:string"/>
                        <xsd:attribute name = "recipeStep" type = "xsd:integer"/>
                        <xsd:attribute name = "command" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Nozzle">
                <xsd:complexType>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "nozzleType" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "headId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "nozzleSegmentId" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.16 MaterialHandlerChanged

URL: http://webstds.ipc.org/2546/MaterialHandlerChanged.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
         elementFormDefault = "qualified">
        <xsd:element name = "MaterialHandlerChanged">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "MaterialHandler"/>
                                <xsd:element ref = "Component"/>
                                <xsd:element ref = "ComponentValidation" minOccurs = "0"/>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "messageInitiator">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "OPERATOR"/>
                                                <xsd:enumeration value = "HOST"/>
                                                <xsd:enumeration value = "AUTOMATIC"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "MaterialHandler">
                <xsd:complexType>
                        <xsd:attribute name = "materialSupplyArea" type = "xsd:string"/>
                        <xsd:attribute name = "trackId" use = "required" type = "xsd:integer"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "materialHandlerType" use = "required">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "FEEDER"/>
                                                <xsd:enumeration value = "TRAYSERVER"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                        <xsd:attribute name = "materialHandlerTableId" type = "xsd:string"/>
                        <xsd:attribute name = "feederType" type = "xsd:string"/>
                        <xsd:attribute name = "feederDivision" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerType" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerTower" type = "xsd:integer"/>
                        <xsd:attribute name = "trayServerLocation" use = "required" type = "xsd:integer"/>
```

```
                        <xsd:attribute name = "traySection" type = "xsd:string"/>
                        <xsd:attribute name = "trayDivision" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Component">
                <xsd:complexType>
                        <xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "designator" type = "xsd:string"/>
                        <xsd:attribute name = "imageId" type = "xsd:string"/>
                        <xsd:attribute name = "recognitionReference" type = "xsd:string"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "package" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "ComponentValidation">
                <xsd:complexType>
                        <xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "package" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.17 ComponentNotRecognized

URL: http://webstds.ipc.org/2546/ComponentNotRecognized.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
     elementFormDefault = "qualified">
    <xsd:element name = "ComponentNotRecognized">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element ref = "Recipe" minOccurs = "0"/>
                <xsd:element ref = "Nozzle"/>
                <xsd:element ref = "MaterialHandler"/>
                <xsd:element ref = "Component"/>
                <xsd:element ref = "Extensions" minOccurs = "0"/>
            </xsd:sequence>
            <xsd:attribute name = "warningType" use = "required">
                <xsd:simpleType>
                    <xsd:restriction base = "xsd:string">
                        <xsd:enumeration value = "MissingLead"/>
                        <xsd:enumeration value = "LeadOutOfTolerance"/>
                        <xsd:enumeration value = "Coplanarity"/>
                        <xsd:enumeration value = "BadSize"/>
                    </xsd:restriction>
                </xsd:simpleType>
            </xsd:attribute>
        </xsd:complexType>
    </xsd:element>
    <xsd:element name = "MaterialHandler">
        <xsd:complexType>
            <xsd:attribute name = "materialSupplyArea" type = "xsd:string"/>
            <xsd:attribute name = "trackId" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "partId" type = "xsd:string"/>
            <xsd:attribute name = "materialHandlerType" type = "xsd:string"/>
            <xsd:attribute name = "materialHandlerTableId" type = "xsd:string"/>
            <xsd:attribute name = "feederType" type = "xsd:string"/>
            <xsd:attribute name = "feederDivision" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "trayServerType" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "trayServerTower" type = "xsd:string"/>
            <xsd:attribute name = "trayServerLocation" use = "required" type = "xsd:string"/>
            <xsd:attribute name = "traySection" type = "xsd:string"/>
```

```
                <xsd:attribute name = "trayDivision" type = "xsd:string"/>
            </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Component">
            <xsd:complexType>
                <xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
                <xsd:attribute name = "designator" type = "xsd:string"/>
                <xsd:attribute name = "imageId" type = "xsd:string"/>
                <xsd:attribute name = "recognitionReference" type = "xsd:string"/>
                <xsd:attribute name = "partId" type = "xsd:string"/>
                <xsd:attribute name = "package" type = "xsd:string"/>
            </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Recipe">
            <xsd:complexType>
                <xsd:attribute name = "recipeId" use = "required" type = "xsd:string"/>
                <xsd:attribute name = "revision" type = "xsd:string"/>
                <xsd:attribute name = "zoneRange" type = "xsd:string"/>
                <xsd:attribute name = "laneRange" type = "xsd:string"/>
                <xsd:attribute name = "recipeStep" type = "xsd:integer"/>
                <xsd:attribute name = "command" type = "xsd:string"/>
            </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Nozzle">
            <xsd:complexType>
                <xsd:attribute name = "partId" type = "xsd:string"/>
                <xsd:attribute name = "nozzleType" use = "required" type = "xsd:string"/>
                <xsd:attribute name = "headId" use = "required" type = "xsd:string"/>
                <xsd:attribute name = "nozzleSegmentId" use = "required" type = "xsd:string"/>
            </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.18 MaterialHandlerTableInstalled

URL: http://webstds.ipc.org/2546/MaterialHandlerTableInstalled.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

MaterialHandlerTableInstalled
messageInitiator */string
MaterialHandler
materialSupplyArea string
trackId integer
partId string
materialHandlerType */string
materialHandlerTableId string
feederType string
feederDivision string
trayServerType string
trayServerTower integer
trayServerLocation integer
traySection string
trayDivision string
Component
componentId string
designator string
imageId string
recognitionReference string
partId string
package string
Extensions

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
         elementFormDefault = "qualified">
        <xsd:element name = "MaterialHandlerTableInstalled">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "MaterialHandler"/>
                                <xsd:element ref = "Component" minOccurs = "0"/>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "messageInitiator">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "OPERATOR"/>
                                                <xsd:enumeration value = "HOST"/>
                                                <xsd:enumeration value = "AUTOMATIC"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "MaterialHandler">
                <xsd:complexType>
                        <xsd:attribute name = "materialSupplyArea" type = "xsd:string"/>
                        <xsd:attribute name = "trackId" use = "required" type = "xsd:integer"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "materialHandlerType" use = "required">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "FEEDER"/>
                                                <xsd:enumeration value = "TRAYSERVER"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                        <xsd:attribute name = "materialHandlerTableId" type = "xsd:string"/>
                        <xsd:attribute name = "feederType" type = "xsd:string"/>
                        <xsd:attribute name = "feederDivision" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerType" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerTower" type = "xsd:integer"/>
                        <xsd:attribute name = "trayServerLocation" use = "required" type = "xsd:integer"/>
                        <xsd:attribute name = "traySection" type = "xsd:string"/>
                        <xsd:attribute name = "trayDivision" type = "xsd:string"/>
                </xsd:complexType>
```

```
        </xsd:element>
        <xsd:element name = "Component">
                <xsd:complexType>
                        <xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "designator" type = "xsd:string"/>
                        <xsd:attribute name = "imageId" type = "xsd:string"/>
                        <xsd:attribute name = "recognitionReference" type = "xsd:string"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "package" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

8.19 MaterialHandlerTableUnInstalled

URL: http://webstds.ipc.org/2546/MaterialHandlerTableUnInstalled.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
	 elementFormDefault = "qualified">
	<xsd:element name = "MaterialHandlerTableUnInstalled">
		<xsd:complexType>
			<xsd:sequence>
				<xsd:element ref = "MaterialHandler"/>
				<xsd:element ref = "Component" minOccurs = "0"/>
				<xsd:element ref = "Extensions" minOccurs = "0"/>
			</xsd:sequence>
			<xsd:attribute name = "messageInitiator">
				<xsd:simpleType>
					<xsd:restriction base = "xsd:string">
						<xsd:enumeration value = "OPERATOR"/>
						<xsd:enumeration value = "HOST"/>
						<xsd:enumeration value = "AUTOMATIC"/>
					</xsd:restriction>
				</xsd:simpleType>
			</xsd:attribute>
		</xsd:complexType>
	</xsd:element>
	<xsd:element name = "MaterialHandler">
		<xsd:complexType>
			<xsd:attribute name = "materialSupplyArea" type = "xsd:string"/>
			<xsd:attribute name = "trackId" use = "required" type = "xsd:integer"/>
			<xsd:attribute name = "partId" type = "xsd:string"/>
			<xsd:attribute name = "materialHandlerType" use = "required">
				<xsd:simpleType>
					<xsd:restriction base = "xsd:string">
						<xsd:enumeration value = "FEEDER"/>
						<xsd:enumeration value = "TRAYSERVER"/>
					</xsd:restriction>
				</xsd:simpleType>
			</xsd:attribute>
			<xsd:attribute name = "materialHandlerTableId" type = "xsd:string"/>
			<xsd:attribute name = "feederType" type = "xsd:string"/>
			<xsd:attribute name = "feederDivision" use = "required" type = "xsd:string"/>
			<xsd:attribute name = "trayServerType" use = "required" type = "xsd:string"/>
			<xsd:attribute name = "trayServerTower" type = "xsd:integer"/>
			<xsd:attribute name = "trayServerLocation" use = "required" type = "xsd:integer"/>
			<xsd:attribute name = "traySection" type = "xsd:string"/>
			<xsd:attribute name = "trayDivision" type = "xsd:string"/>
		</xsd:complexType>
```

```
		</xsd:element>
		<xsd:element name = "Component">
			<xsd:complexType>
				<xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
				<xsd:attribute name = "designator" type = "xsd:string"/>
				<xsd:attribute name = "imageId" type = "xsd:string"/>
				<xsd:attribute name = "recognitionReference" type = "xsd:string"/>
				<xsd:attribute name = "partId" type = "xsd:string"/>
				<xsd:attribute name = "package" type = "xsd:string"/>
			</xsd:complexType>
		</xsd:element>
		<xsd:element name = "Extensions"/>
</xsd:schema>
```

8.20 MaterialHandlerDivisionUp

URL: http://webstds.ipc.org/2546/MaterialHandlerDivisionUp.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
         elementFormDefault = "qualified">
        <xsd:element name = "MaterialHandlerDivisionUp">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "MaterialHandler"/>
                                <xsd:element ref = "Component" minOccurs = "0"/>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "messageInitiator">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "OPERATOR"/>
                                                <xsd:enumeration value = "HOST"/>
                                                <xsd:enumeration value = "AUTOMATIC"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "MaterialHandler">
                <xsd:complexType>
                        <xsd:attribute name = "materialSupplyArea" type = "xsd:string"/>
                        <xsd:attribute name = "trackId" use = "required" type = "xsd:integer"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "materialHandlerType" use = "required">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "FEEDER"/>
                                                <xsd:enumeration value = "TRAYSERVER"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                        <xsd:attribute name = "materialHandlerTableId" type = "xsd:string"/>
                        <xsd:attribute name = "feederType" type = "xsd:string"/>
                        <xsd:attribute name = "feederDivision" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerType" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerTower" type = "xsd:integer"/>
                        <xsd:attribute name = "trayServerLocation" use = "required" type = "xsd:integer"/>
                        <xsd:attribute name = "traySection" type = "xsd:string"/>
                        <xsd:attribute name = "trayDivision" type = "xsd:string"/>
                </xsd:complexType>
```

```
		</xsd:element>
		<xsd:element name = "Component">
			<xsd:complexType>
				<xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
				<xsd:attribute name = "designator" type = "xsd:string"/>
				<xsd:attribute name = "imageId" type = "xsd:string"/>
				<xsd:attribute name = "recognitionReference" type = "xsd:string"/>
				<xsd:attribute name = "partId" type = "xsd:string"/>
				<xsd:attribute name = "package" type = "xsd:string"/>
			</xsd:complexType>
		</xsd:element>
		<xsd:element name = "Extensions"/>
</xsd:schema>
```

8.21 MaterialHandlerRefilled

URL: http://webstds.ipc.org/2546/MaterialHandlerRefilled.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
         elementFormDefault = "qualified">
        <xsd:element name = "MaterialHandlerRefilled">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "MaterialHandler"/>
                                <xsd:element ref = "Component" minOccurs = "0"/>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "messageInitiator">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "OPERATOR"/>
                                                <xsd:enumeration value = "HOST"/>
                                                <xsd:enumeration value = "AUTOMATIC"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "MaterialHandler">
                <xsd:complexType>
                        <xsd:attribute name = "materialSupplyArea" type = "xsd:string"/>
                        <xsd:attribute name = "trackId" use = "required" type = "xsd:integer"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "materialHandlerType" use = "required">
                                <xsd:simpleType>
                                        <xsd:restriction base = "xsd:string">
                                                <xsd:enumeration value = "FEEDER"/>
                                                <xsd:enumeration value = "TRAYSERVER"/>
                                        </xsd:restriction>
                                </xsd:simpleType>
                        </xsd:attribute>
                        <xsd:attribute name = "materialHandlerTableId" type = "xsd:string"/>
                        <xsd:attribute name = "feederType" type = "xsd:string"/>
                        <xsd:attribute name = "feederDivision" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerType" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "trayServerTower" type = "xsd:integer"/>
                        <xsd:attribute name = "trayServerLocation" use = "required" type = "xsd:integer"/>
                        <xsd:attribute name = "traySection" type = "xsd:string"/>
                        <xsd:attribute name = "trayDivision" type = "xsd:string"/>
                </xsd:complexType>
```

```
		</xsd:element>
		<xsd:element name = "Component">
			<xsd:complexType>
				<xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
				<xsd:attribute name = "designator" type = "xsd:string"/>
				<xsd:attribute name = "imageId" type = "xsd:string"/>
				<xsd:attribute name = "recognitionReference" type = "xsd:string"/>
				<xsd:attribute name = "partId" type = "xsd:string"/>
				<xsd:attribute name = "package" type = "xsd:string"/>
			</xsd:complexType>
		</xsd:element>
		<xsd:element name = "Extensions"/>
</xsd:schema>
```

8.22 ComponentReject

URL: http://webstds.ipc.org/2546/ComponentReject.xsd

Extends: http://webstds.ipc.org/2501Envelope.xsd (Publish and Send Elements)

Graphical Representation:

rejectLocation
string
ComponentReject
Component
Extensions
componentId
string
designator
string
imageId
string
recognitionReference
string
partId
string
package
string

Schema:

```
<?xml version = "1.0" encoding = "UTF-8"?>
<!--Generated by XML Authority. Conforms to w3c http://www.w3.org/2001/XMLSchema-->
<xsd:schema xmlns:xsd = "http://www.w3.org/2001/XMLSchema"
         elementFormDefault = "qualified">
        <xsd:element name = "ComponentReject">
                <xsd:complexType>
                        <xsd:sequence>
                                <xsd:element ref = "Component" minOccurs = "0"/>
                                <xsd:element ref = "Extensions" minOccurs = "0"/>
                        </xsd:sequence>
                        <xsd:attribute name = "rejectLocation" use = "required" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Component">
                <xsd:complexType>
                        <xsd:attribute name = "componentId" use = "required" type = "xsd:string"/>
                        <xsd:attribute name = "designator" type = "xsd:string"/>
                        <xsd:attribute name = "imageId" type = "xsd:string"/>
                        <xsd:attribute name = "recognitionReference" type = "xsd:string"/>
                        <xsd:attribute name = "partId" type = "xsd:string"/>
                        <xsd:attribute name = "package" type = "xsd:string"/>
                </xsd:complexType>
        </xsd:element>
        <xsd:element name = "Extensions"/>
</xsd:schema>
```

Appendix A – IPC Web-based Standards (IPC25XX)

The web-based standards (IPC 25XX) are designed to foster application integration and electronic commerce through data and information interchange standards based on XML. It assumes that application programs (including equipment interfaces) are distinct entities, and application integration takes place using a loosely coupled, message-passing approach. There is no need for a common object model, programming language, network protocol, persistent storage mechanism or operating system for two applications to exchange XML messages formatted using the web-based standards. The two applications simply need to be able to format, transmit, receive and consume a standardized XML message.

A web-based standards series has been identified for each of the value-added activities occurring throughout the product life cycle of an electronics product. The web-based standards are:

IPC-2500 – Framework Standard

IPC-2510 – Product Data Representation

IPC-2520 – Product Data Quality

IPC-2530 – Surface Mount Equipment Standard Recipe File Format

IPC-2540 – Shop Floor Equipment Communications

IPC-2550 – Manufacturing Execution Systems Communications

IPC-2560 – Enterprise Resource Planning Systems Communications

IPC-2570 – Supply Chain Communications

Table A-1 shows the correlation of the different standards in each of the series. Although not every standard has been started, the figure represents a coordinated opportunity to maintain consistency throughout the standard development cycle.

Table A-1 CAD/CAM Standardization

IPC Number/ Function	-xxx1 Generic	-xxx2 Administ	-xxx3 Documnt	-xxx4 Board Fabricat	-xxx5 Bare Bd Test	-xxx6 Assy Manufac	-xxx7 Assy/ Test/ Insp.	-xxx8 Comp. & Material	-xxx9 Informa. Modeling
IPC-2500 CAMX Framework	IPC-2501 Proposal								
IPC-2510 GenCAM Product Data	IPC-2511B (Pub)	IPC-2512A (Pub)	IPC-2513A (Pub)	IPC-2514A (Pub)	IPC-2515A (Pub)	IPC-2516A (Pub)	IPC-2517A (Pub)	IPC-2518A (Pub)	IPC-2519A (Pub)
IPC-2520 Quality Product Data				IPC-2524 (Pub)					
IPC-2530 SRFF Process Data Recipe file	IPC-2531 (Pub)								
IPC-2540 Shop Floor Communicate	IPC-2541 (Pub)					IPC-2546 (Pub)	IPC-2547 (Pub)		
IPC-2550 Execution Communicate	IPC-2551 Working draft			IPC-2554 Working draft		IPC-2556 PINS			
IPC-2560 Enterprise Communicate									
IPC-2570 Supply Chain Communicate	IPC-2571 (Pub)					IPC-2576 (Pub)	IPC-2577 Proposal	IPC-2678 (Pub)	
IPC-2580 Application Specific Data	IPC-2581 Proposal								

Messages are the basis of the web-based standards. Messages are the means to integrate applications at the business-process level by defining a loosely coupled, request-based communication process. Since many business processes involve one party performing a service at the request of another party, the mapping of messages to requests is natural. An XML-based messaging system with open, extensible formats captures the essential elements of an electronics business communication message while allowing flexible implementations.

It is anticipated that in the vast majority of interchanges, the exchange of XML documents and messages between trading partners or applications will occur. Implementation using the CAMX Framework Standards will use a simple hyper-text transfer protocol (HTTP) transport, but business can also use other transports including file transfer protocol (FTP) and message queuing technologies.

Until applications have native support for XML, these types of CAMX Framework interchanges will require layered software that transforms native data types into XML.

The IPC 2541 and its sectional standards should provide value in both serialized and non-serialized production environments. In serialized production environments, detailed information from the production process can be gathered from each piece of IPC 2541 compliant equipment. In non-serialized production environments, it should still be possible to gauge overall production efficiency such as number of units produced in a given amount of time, or overall line and equipment status, by analyzing the IPC 2541 messages generated by each piece of IPC 2541 compliant equipment. If a bar code reader is present then a unique item identifier may be the bar code label that is read. If no bar code reader is present then the unique item identifier may be generated by the piece of equipment.